2 PACME

The 2nd PACIFIC-ASIA CONFERENCE ON MECHANICAL ENGINEERING

1898 - 1998 100 KALAYAAN

Theme: " Reconfiguring Mechanical Engineering Beyond the Second Millennium "

September 9 - 11, 1998
Holiday Inn - Manila Pavilion Hotel
United Nations Avenue
Manila, Philippines

Welcome!!!* *Centennial Year of the Philippine Independence* *1998

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NIHON UNIVERSITY
COLLEGE OF SCIENCE AND TECHNOLOGY

Expresses Congratulations
For The Success Of:

THE 2nd PACIFIC ASIA CONFERENCE ON MECHANICAL ENGINEERING (2 PACME)

September 9 - 11, 1998
Manila, Philippines

from:

Nihon University
College Of Science And Technology

The 2nd Pacific-Asia Conference on Mechanical Engineering (2 PACME)

FEATURES AND CONTENTS

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Our cover:

Diverse instruments yet one symphony.
The mosaic cover page consists of photos of turbine, sprocket, gears, robot arm, computer aided and computer integrated manufacturing and bio-mechanical equipment which represent the diverse products and processes in mechanical engineering. This is what the 2nd PACIFIC-ASIA CONFERENCE ON MECHANICAL ENGINEERING is all about - a presentation of different fields and expertise in one rare event. -

Photo source: Reprints from Mechanical Engineering Journal - January 1996, June 1996, December 1996 issues-

***IRTC Press

Organized and Sponsored by:

Republic of the Philippines
TECHNOLOGICAL UNIVERSITY OF THE PHILIPPINES
Ayala Boulevard, Manila

Nihon University
COLLEGE OF SCIENCE AND TECHNOLOGY
Tokyo, Japan

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Department of Science and Technology
PHILIPPINE COUNCIL FOR INDUSTRY & ENERGY RESEARCH
AND DEVELOPMENT
Manila, Philippines

Republic of the Philippines
UNIVERSITY OF THE PHILIPPINES
Diliman, Quezon City

Republic of the Philippines
DE LA SALLE UNIVERSITY
Taft Avenue, Manila

Nihon University
OTA OVERSEAS ACADEMIC INTERCHANGE FUND
Tokyo, Japan

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Integrated Research and Training Center:
INTEGRATED RESEARCH AND TRAINING CENTER FOUNDATION, Inc.,
Ayala Boulevard, Manila

SAVAC NGO
SANKO VOLUNTEERS ASSOCIATION
Tokyo, Japan

TCGI ENGINEERS
Manila, Philippines

Department of Tourism
PHILIPPINE CONVENTION AND VISITORS CORPORATION
Manila, Philippines

Office of the President
of the Philippines
Malacañang

MESSAGE

Warmest greetings to the participants and organizers of the Second Pacific-Asia Conference on Mechanical Engineering (PACME) on September 9-11, 1998.

Now, more than ever, there is a need to give more serious attention to the modernization and growth of the agriculture and industrial sectors where Filipino mechanical engineers play a central role. In this direction, we consider the sustained application of local expertise and materials, and appropriate mechanization and strategic automation and in mitigating as well the adverse impact of the financial crisis besetting the Asia-Pacific region.

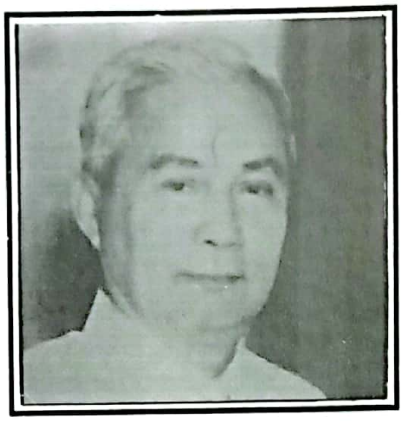
In cognizance of the challenges and opportunities in the coming years, I therefore extend my heartfelt congratulations to the PACME for taking the lead in organizing this significant event. Your chosen theme, "Reconfiguring Mechanical Engineering Beyond the Second Millennium," captures the exigencies of the times and signals the need to break new grounds as we proceed to become a major player in a highly competitive global market.

Best wishes and I hope for the success of this Conference!

JOSEPH EJERCITO ESTRADA

MANILA
September 9, 1998

COMMISSION ON HIGHER EDUCATION
OFFICE OF THE PRESIDENT OF THE PHILIPPINES



MESSAGE

Mechanical engineers from the entire Pacific-Asia are once again gathered together for the 2nd Pacific-Asia Conference on Mechanical Engineering (2PACME). This international scientific meeting of world-class mechanical engineers and distinguished academicians, professionals and manufacturers all over the world is another turning point in our quest for quality and relevant mechanical engineering education.

This year's theme "Reconfiguring Mechanical Engineering beyond the Second Millennium", underscores our mutual desire to effect dramatic stride in the lives of men by achieving significant changes in mechanical engineering practices and schemes. This includes research and effective dissemination of research results.

We, at the Philippine Commission on Higher Education, hope that the 2nd Pacific-Asia Conference on Mechanical Engineering will encourage interactions between basic and applied research in the wide area of Mechanical Engineering, and provide opportunities for the industry and academe to meet and discuss solutions, insights and recommendation towards global development.

Mabuhay!

ANGEL C. ALCALA
Chairman

REPUBLIKA NG PILIPINAS
REPUBLIC OF THE PHILIPPINES
KAGAWARAN NG EDUKASYON, KULTURA AT ISPORTS
DEPARTMENT OF EDUCATION, CULTURE AND SPORTS
DECS Complex, Meralco Avenue
Pasig City, Philippines

Tanggapan ng Kalihim
Office of the Secretary

PHILIPPINES 2000

Sama-Sama sa DECS

MESSAGE

I wish to convey cordial greetings to the organizers and all the participants to the 2nd Pacific-Asia Conference on Mechanical Engineering (2PACME) to be held at Manila Pavilion Holiday Inn on September 9-11 this year.

Competing favorably in the new world order demands from us the highest level of providing conferences to our mechanical engineers. Indeed, there is a need to train our mechanical engineers because they are one of the vital pillars of development. Their expertise is necessary to earn one's rightful place in the global community.

This Conference gives the mechanical engineer-participants the opportunity to tackle vital issues and critical concerns in their areas of responsibility and implement more effective ways in meeting the challenges of their tasks.

May the engineers-participants enjoy sharing their talents with one another, and extend their discoveries to supplement the needs of other participants.

Congratulations and Mabuhay!

Andrew Gonzalez

ANDREW B. GONZALES, FSC
Secretary

E-Mail Address:
OSEC @SKYINET.NET

"Together Let Us Build This Nation Through Education"

Tel. # 02-633-7228 or 7208
Fax # 02-632-0805

Republic of the Philippines
DEPARTMENT OF SCIENCE AND TECHNOLOGY

MESSAGE

The theme of the 2nd Pacific-Asia Conference on Mechanical Engineering *"Reconfiguring Mechanical Engineering Beyond The Second Millennium"*, underscores the inevitability of and the need for change as a precursor to progress in a rapidly changing world.

Mechanical engineers must be sensitive to the demands and the consequent environment of the times they live in so their interventions can address the actual, rather than the perceived, needs of the populace.

We are living in a millennium that shuns the safety of permanence. The future, after all, belongs to the risk takers who anticipate, and even introduce innovations, rather than wait to be acted upon.

I hope this conference will imbue all the participants with the restlessness that goads one to always look beyond what is already there. And I hope this restlessness for change infects the other sectors of society so we can, as one nation, keep in step with progressively evolving global community.

Again, Congratulations and *Mabuhay!*

WILLIAM G. PADOLINA
Secretary

Republic of the Philippines
TECHNOLOGICAL UNIVERSITY OF THE PHILIPPINES
Ayala Blvd., Manila

MESSAGE

On behalf of the Technological University of the Philippines, I would like to extend warm greetings to all participants to the Second Pacific-Asia Conference on Mechanical Engineering.

Mechanical engineers play a critical role in global development. Technologies are fast changing. Demand for the practice is expanding and differing in nature. The 2nd PACME rightfully focuses on "Reconfiguring Mechanical Engineering Beyond the Second Millennium". Scholars and practitioners are brought together for the much needed professional interaction and consultation. Hopefully, this vital first step shall lead to clearer and more relevant mechanical engineering perspective in the new millennium.

I thank TUP's partners in the organization of this conference, and express my appreciation of the work done by the international advisory committee. Congratulations to the officials, faculty and staff of the Integrated Research and Training Center, and to all those who are involved in this worthy undertaking.

Again, as Co-Chairman of the International Organizing Committee, I welcome all of you and am hoping that you will have a fruitful stay in the Philippines.

FREDERICK SO. PADA
President

NIHON UNIVERSITY

COLLEGE OF SCIENCE & TECHNOLOGY

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1-8, KANDA SURUGADAI, CHIYODA-KU,

TOKYO, 101-8308 JAPAN

MESSAGE

It is my great pleasure to extend warmest greetings and best wishes to all participants of the Second Pacific-Asia Conference on Mechanical Engineering to be held in Manila on September 9 - 11, 1998.

We have perceived environmental crises of the earth in the end of this century. Even if the intensively rapid development of the technology may bring the circumstance, it is true that the new technology is indispensable in order to retain the beautiful earth for the next century. It is really expected that the Second Pacific-Asia Conference on Mechanical Engineering would perform an important role for realizing comfortable environment.

I believe that this international conference organized by the Technological University of the Philippines, University of the Philippines, De La Salle University, PCIERD and the College of Science and Technology of Nihon University would cultivate and strengthen friendship between Philippines and Japan.

Katsue Kojima

KATSUE KOJIMA
Dean

Republic of the Philippines
UNIVERSITY OF THE PHILIPPINES
Diliman, Quezon City

MESSAGE

My warmest greetings to the participants of the 2nd Pacific-Asia Conference on Mechanical Engineering to be held in Manila from September 9 to 11, 1998.

I am pleased to note that international scholars and professionals continue to place themselves in the service of society so we may rise to the challenges of development in a fast-changing world.

Your conference comes at a most opportune time indeed. In barely a year, dramatic changes have swept the economic landscape of most Asian countries which development, it is foreseen, will likely affect the international community as well. And engineering, as the cornerstone of development must now play a more critical role in economic recovery.

May you, as architects of technology and industry, continue to generate new knowledge and technologies. Together with industry, may you usher the world into a progressive new millennium.

CLARO T. LLAGUNO
Chancellor

Republic of the Philippines
DE LA SALLE UNIVERSITY
Taft Ave., Manila

MESSAGE

My congratulations to the organizers of this year's Pacific-Asia Conference on Mechanical Engineering. The focus of this year's discussions augurs well for the country and the Asia-Pacific region as well. Innovations in theory and applications in the industries where mechanical engineering plays a crucial part will boost productivity and growth opportunities in the region.

The technical papers outlined in the program reflect the varied far-reaching impact of the mechanical engineering profession in the global economy. Hopefully, the discussions will generate meaningful solutions and address important concerns relevant to both the profession in particular and the society in general.

As well, my gratitude for giving De La Salle Unviersity the opportunity to present its advances in the field of mechanical engineering. We at De La Salle have always fostered a rich culture and tradition of knowledge generation and transmission. We are happy to share our expertise and learn from others as well during this three-day conference.

Welcome and best wishes to all participants and guests.

Yours in St. La Salle,

Carmelita Quebengco

CARMELITA I. QUEBENGCO
Acting President

Republic of the Philippines
Department of Science and Technology
PHILIPPINE COUNCIL FOR INDUSTRY & ENERGY RESEARCH & DEVELOPMENT

PHILIPPINES 2000

MESSAGE

I extend my warm greetings to the delegates of the 2nd Pacific-Asia Conference on Mechanical Engineering (PACME) and to the Organizing Committee led by the Technological University of the Philippines (TUP)-Integrated Research and Training Center, Nihon University, Rajamangala Institute of Technology, University of the Philippines, De La Salle University, Commission on Higher Education (CHED) and the Philippine Council for Industry and Energy Research and Development (PCIERD).

It is very timely that the holding of this conference of international magnitude coincides with the twin symbolic moments in our history - the celebration of the Philippine Centennial and the period of the new presidency. In the goal of the present administration to bring prosperity and exploit all available resources, we find mechanical engineering and its allied disciplines performing functions crucial to national development goals and programs.

As one of the pillars of development efforts, the mechanical engineering discipline deserves its rightful place in society. The demands of the new millennium will make even greater the role of mechanical engineers in carrying out the formidable task of nation building.

May this gathering achieve its goals and we nurture the hope that this event will spur initiatives for unified action and productivity among the participants.

Lydia G. Tansinsin

LYDIA G. TANSINSIN
Assistant Secretary, DOST &
Officer-in-Charge, PCIERD

DEPARTMENT OF MECHANICAL ENGINEERING
COLLEGE OF SCIENCE & TECHNOLOGY
NIHON UNIVERSITY
1-8, KANDA SURUGADAI CHIYODA-KU,
TOKYO, 101-8308 JAPAN

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MESSAGE

It is my pleasure and honor to be given the opportunity to extend my warmest greetings to the participants of the Second Pacific-Asia Conference on Mechanical Engineering to be held in Manila on September 9-11, 1998.

It is great that the Second Pacific-Asia Conference on Mechanical Engineering has so many participants who gather from more than twenty-four countries over the world for discussing the topics in the latest frontiers of mechanical research. I admire the intensive efforts of the IRTC staff and many others who made every endeavor to realize the Conference.

I fervently wish that this International Conference organized by the Technological University of the Philippines, University of the Philippines, De La Salle University, PCIERD and the College of Science and Technology of Nihon University would promote mutual understanding between Philippines and Japan.

Congratulations and best wishes for a successful conference

西村 哲

TETSU NISHIMURA
Chairman

INTEGRATED RESEARCH AND TRAINING CENTER FOUNDATION, INC.

MESSAGE

To have been invited to participate in the management of the 2nd Pacific-Asia Conference on Mechanical Engineering is a privilege indeed. To have been given this rare opportunity to greet the men and women of the conference is a singular honor in itself.

It is with humble heart that we join the university communities of the Technological University of the Philippines, University of the Philippines, De La Salle University and Nihon University in welcoming academics from various universities of the world, mechanical engineering practitioners and professionals here and abroad, and support groups too numerous too mention, to the 2nd Pacific-Asia Conference on Mechanical Engineering, as they buckle down to dissect the wherefore of the discipline in face of the socio-technological challenges it presently faces.

We fervently hope that this 3-day conference provides the avenue to enhance and promote study of, and enrich relationship among workers of mechanical engineering.

LORETO G. AGUILA
President, IRTCF Inc.,

IRTC Bldg., Technological University of the Philippines Ayala Blvd., cor San Marcelino St., Ermita Manila Tel. No.: 521-40-86 Fax No.: 521-40-62

Technological University of the Philippines
INTEGRATED RESEARCH AND TRAINING CENTER
Ayala Blvd., Manila

MESSAGE

On behalf of the 2nd PACME Organizing Committee and the Integrated Research and Training Center, we extend our warmest welcome to all participants and guests of the 1998 Pacific-Asia Conference on Mechanical Engineering.

It is an honor for the IRTC-TUP to play an active role in the convening of experts, academicians, students and partners in industry from all over the world to exchange ideas and form linkages towards global development and networking. On this occasion, the active role of Mechanical Engineers as primemovers of industrialization is once again called to a challenge. May this gathering be a catalyst to meet the advances of science and technology at a global perspective.

It is our privilege to work with the College of Science and Technology of Nihon University, University of the Philippines-Diliman, De La Salle University, and PCIERD of the Department of Science and Technology in this international endeavor. On behalf of the Organizing Committee, we thank all the distinguished speakers, chairpersons, advisory boards and international executive council for their valuable assistance in making this rare venture successful. And to all participants, valued donors and sponsors, we say - Thank you and MABUHAY.

P. Jorillo Jr.

PABLO A. JORILLO JR.,
Executive Director, and
Chairman, 2nd PACME Organizing
Committee

The 2nd Pacific Asia Conference on Mechanical Engineering

PROGRAMME

DAY I WEDNESDAY, SEPTEMBER 09, 1998

08:00 **OPENING CEREMONY**
Master of Ceremony: Nenet C. Graza, Technological University of the Philippines

National Anthem

Welcome Address

DR. FREDERICK SO. PADA
President
Technological University of the Philippines
Chairman, International Executive Committee
2nd PACME

DR. ANGEL C. ALCALA
Chairman
Commission on Higher Education
Chairman, International Executive Committee
2nd PACME

DR. KATSUE KOJIMA
Dean, College of Science and Technology
Nihon University, Japan

HON. LYDIA G. TANSINSIN
Assistant Secretary, DOST & Officer-in-Charge
Philippine Council for Industry and Energy Research and Development

DR. CLARO T. LLAGUNO
Chancellor
University of the Philippines

DR. CARMELITA I. QUEBENGCO
Acting President
De La Salle Univiersity

Distinguished Keynote Address

His Excellency
PRESIDENT JOSEPH EJERCITO ESTRADA
Republic of the Philippines

10:00 COFFEE BREAK

10:30- **OPENING OF PLENARY SESSION**
Chair: Prof. T. Nishimura (Japan-NU)
Vice Chair: Prof. L. Aguila (Philippines-TUP)

THE PRIVATIZATION OF THE PHILIPPINES' METROPOLITAN WATERWORKS AND SEWERAGE SYSTEM
Reynaldo B. Vea, Administrator, Metropolitan Waterworks and Sewerage System, Philippines

AEOLIAN TONES FROM TWO-DIMENSIONAL CYLINDERS,
Dr. Hajime Fujita, Nihon University, Japan

RECENT CHANGES IN ENGINEERING EDUCATION IN AUSTRALIA,
William WS. Charters, Professor in Mechanical Engineering, University of Melbourne, Australia

12:00 LUNCH BREAK

PARALLEL SCIENTIFIC SESSIONS

13:00 SESSION 3A: MAINTENANCE AND MANUFACTURING ENGINEERING

Chair: Dr. A. Maglaya (Philippines-DLSU)
Vice Chair: Prof. K. Katoh (Japan-NU)

- DESIGN AND DEVELOPMENT OF A NEW POWER-DRIVEN STRIPPER HARVESTER WITH RETHRESHER AND CLEANER
  R. Bayona, A. Gopez, G. Salazar (Philippines) - De La Salle University

SESSION 3B: ENERGY AND THERMODYNAMICS

Chair: Dr. K. Yoshida (Japan-NU)
Vice Chair: Mr. R. Angangco (Philippines-UP)

- PRE-FLAME REACTION UNDER KNOCKING OPERATION IN A SPARK IGNITION ENGINE
  K. Akimune, K. Komuro, Y. Ota, T. Matsushita, K. Yoshida, H. Shoji, A. Saima, (Japan) - Nihon University

SESSION 3C: MEASUREMENT AND CONTROL

Chair: Prof. N. Kawahata (Japan-NU)
Vice Chair: Prof. A. Chua (Phils-DLSU)

- MEASUREMENT OF STATIC AND DYNAMIC SUBMICRON DEFORMATION BY HOLOGRAPHIC INTERFEROMETRY
  H. Hatogochi, Y. Shimbori (Japan) - Nihon University

- EXPERIMENTAL AND THEORETICAL ANALYSIS OF DRAW BEAD FORCE
  Y. Kitakaze, G. Kurokawa, M. Hoshino, Y.Uchida (Japan) - Nihon University

- FILIPINO-OWNED AND MANAGED AUTOMOTIVE COMPANIES: A CASE STUDY IN MANAGEMENT OF TECHNOLOGY
  M. Belino, E. de la Cruz, G. Salazar (Philippines) - De La Salle University

- FINITE ELEMENTAL SIMULATION FOR PRESS BENDING OF ALUMINUM EXTRUDED SHAPES WITH INNER PADS
  M. Takahashi, M. Hoshino, Y. Uchida (Japan) - Nihon University

- GUIDING STRATEGY FOR CONDITION BASED MAINTENANCE
  B. Rajamony, M. Berhan (Malaysia) - Institut Teknologi MARA

- EFFECT OF PROCESS CONDITIONS ON THE PRODUCT YIELDS FROM INTEGRATED CATALYTIC UPGRADING AND FLUIDISED BED PYROLYSIS OF OIL PALM SHELL
  F. Ani, M. Islam (Malaysia) Universiti Teknologi, Malaysia

- STUDY ON VORTEX WHISTLE IN SWIRL BURNERS
  S. Okumura, Y. Tsuruoka, M. Tanabe, K. Aoki (Japan) Nihon University

- LASER SPECKLE INTERFEROMETRY: A PRECISION MEASURING TOOL FOR INDUSTRY
  H. Yadav, B. Chaudhuri (India) - Jadavpur University

- APPLICATION OF FUZZY LOGIC TO CONTROL A PRESSURELESS BOTTLE COMBINER
  E. Calilung (Philippines.) - De La Salle University

- MEASUREMENTS AND CONTROL OF BRIDGES DURING CONSTRUCTION AND LONG TERM
  T. Javor , E. Javor (Slovakia) - Expert Centrum

- STABILITY CHART FOR MATHIEU'S EQUATION BY NUMERICAL NTEGRATION AND ENERGY METHOD
  G. Jazar, B. Shiari, N. Amanifard (Iran) - Gilan University

14:40 COFFEE BREAK

15:00 -16:40 SESSION 4A: MAINTENANCE AND MANUFACTURING ENGINEERING

Chair: Dr. F. Chinesta (Spain-UPV)
Vice Chair: Engr. N. Pena (Philippines DOST)

- DEVELOPMENT OF AN EXTRUSION MACERATOR FOR RAPID DEWATERING OF WATER HYACINTH (EICHONORIA CRASSIPES)
  E. Calilung, D. Clough (Philippines) - De La Salle University

- CHARACTERISITCS OF POWDER EXTRUSION WITH SHEAR STRAIN
  M. Hoshino, Y. Uchida, S. Nakamura (Japan) - Nihon University

- CONVEYOR BELT MOTION CONTROLLER USING FUZZY LOGIC
  E. Dadios, (Philippines) - De La Salle University

- SHEET METAL HINGES CURLING DEVICE (FOR ELECTRICAL ENCLOSURES)
  R. de Lumen (Philippines) - Technological University of the Philippines

- AUTOMATIC TRANSFORMER REWINDER
  R. Sandoval (Philippines) - Technological University of the Philippines

SESSION 4B: ENERGY AND THERMODYNAMICS

Chair: Dr. R. Garcia (Philippines - UP)
Vice Chair: Prof. A. Muramatsu (Japan-NU)

- A STUDY ON ACTIVE EFFECT OF OH RADICAL WITH INTERNAL EGR
  A. Yamazaki, S. Hashimoto, Y. Amino, K. Yoshida, H. Shoji, A. Saima, (Japan) - Nihon University

- MEASUREMENT OF SURFACE TENSION OF TFE/E181 AND TFE/NMP BINARY SYSTEMS
  K. Ogawa, N. Isshiki, H. Koga, T. Nakamura (Japan) - Nihon University

- STREAM AND STABILIZING EFFECTS OF DIFFUSIONS FLAME IN MAGNETIC FIELD
  H. Tanaka, K. Yoshida, H. Shoji, A. Saima, (Japan) The National Defense Academy

- ON CATALYST ASSISTED COMBUSTION WITH CATALYST TEMPERATURE LIMITING
  M. Yamagami, F. Hanba, M. Tanabe, K. Aoki, (Japan) - Nihon University

SESSION 4C: MEASUREMENT AND CONTROL

Chair: Dr. E. Calilung (Philippines - DLSU)
Vice Chair: Dr. H. Hatagochi (Japan-NU)

- APPLICATION OF ARTIFICIAL INTELLIGENCE TO ELECTRICAL POWER SYSTEM FAULTS
  E. Dadios (Philippines) - De La Salle University

- PART MATING METHODS AND EQUIPMENT WITH THE KALMAN FILTER IN FOCUS
  A. Chua, J. Katupitiya (PhilIppines) - De La Salle University

- A STUDY OF THE SURFACE INSPECTION SYSTEM IN A HOT ROLLING LINE FOR A STEEL PRODUCTS
  T. Sugimoto (Japan) - Nihon Univeristy

- NON-CONTACT DYNAMIC MEASUREMENT DEVICE OF CROSS SECTIONAL SHAPE BY LIGHT SECTIONING METHOD
  H. Yoshida, N. Kawahata (Japan) - Nihon University

- DEVELOPMENT OF SERVO-TYPE VELOCITY AND DISPLACEMENT SENSOR FOR THE VIBRATION CONTROL OF FLEXIBLE STRUCTURES
  Y. Satoh, H. Saitoh, Y. Itoh, Y. Gatade, K. Seto, (Japan) - Nihon University

16:40 18:30 SESSION 5A: MAINTENANCE AND MANUFACTURING ENGINEERING

Chair: Prof. W. Charters (Australia-UM)
Vice Chair: Prof. E. Dadios (Philippines-DLSU)

- COMPRESSED HOT DRY AIR DRYER FOR FOOD AND HERBS
  R. Hizon, V. Angeles (Philippines) - Technological University of the Philippines

SESSION 5B: ENERGY AND THERMO-DYNAMICS

Chair: Dr. J. Akbarov (Turkey-YTU)
Vice Chair: Dr. F. Vinluan (Philippines-DOST)

- THE ENGINE PERFORMANCE OF ULTRA-LEAN MIXTURE IGNITED BY DIESEL FUEL INJECTION
  K. Watanabe, D. Kotani, K. Yoshida, H. Shoji, H. Tanaka (Japan) - Nihon University

SESSION 5C: FLUID MECHANICS

Chair: Prof. H. Fujita (Japan-NU)
Vice Chair: Dr. A. Culaba (Philippines-DLSU)

- THREE DIMENSIONAL EFFECT ON THE WAKE OF A TWO DIMENSIONAL ROUGHNESS PLACED IN A LAMINAR FLAT PLATE BOUNDARY LAYER
  K. Ono, M. Ardekani, H. Munakata (Japan) - Nihon University

- DESIGN AND DEVELOPMENT OF THE AIRCONDITIONING DRYING EQUIPMENT
  R. Hizon, V. Angeles, (Philippines) - Technological University of the Philippines

- DESIGN AND DEVELOPMENT OF AUTOMATIC FOLD LAUNDRY DRYER
  J. Advincula (Philippines) - Technological University of the Philippines

- LIFE CYCLE ANALYSIS OF MANUFACTURING PROCESSES
  A. Culoba, (Philippines) - De La Salle University

- CONCENTRATION AND VELOCITY MEASUREMENTS IN GAS FLOWS WITH LARGE VELOCITY FLUCTUATION
  A. Muramatsu, Y. Era (Japan) - Nihon University

- THE RELATIONSHIP OF GROWTH BETWEEN PLASMA JET AND INITIAL FLAME KERNEL IN PLASMA JET IGNITION
  D. Teto, K. Tanaka, K. Yoshida, A. Saima, H. Tanaka, H. Shoji (Japan) - Nihon University

- DEVELOPMENT OF THE PRACTICAL TYPE PLASMA JET IGNITER
  H. Tanaka, D. Teto, K. Yoshida, H. Shoji, H. Tanaka, (Japan) - Nihon Univeristy

- INTERACTION OF DISTURBANCES FORMED ARTIFICIALLY BY THIN JETS
  T. Sugamata, A. Matsumoto (Japan) - Nihon University

- STATISTICAL ANALYSIS ON HIGH SHEAR-STRESS STREAKS OF TURBULENT BOUNDARY LAYER
  M. Kimura, S. Tung, C. M. Ho, (Japan) - Nihon University

- DILUTE VERTICAL TRANSPORTATION USING SPIRAL FLOW
  M. Takei, M. Ochi, K. Horii, YH Zhao, H. Li, (Japan) - Nihon University

DAY 2 - THURSDAY, SEPTEMBER 10, 1998

PARALLEL SCIENTIFIC SESSIONS

08:00-08:30

SESSION 6A: GUEST LECTURE 1

Chair: Prof. F. Argamosa (Philippines.-TUP)
Prof. M. Dakanay (Philippines-TUP)

- FORMING PROCESSES MODELLING INVOLVING MOLTEN SHORT FIBERS COMPOSITES: STATE OF THE ART AND RECENT DEVELOPMENTS
  F. Chinesta, A. Poitou, R. Torres, I. Monton, F. Meslin, (Spain) - Universidad Politecnica de Valencia

SESSION 6B: GUEST LECTURE 2

Chair: Prof. F. Manegdeg (Philippines-UP)
Vice Chair: Prof. Q. Almeniana (Philippines-TUP)

- SMART STRUCTURES AT NTU
  Dr. Anand Asundi (Singapore) Nanyang Technological University

SESSION 6C: GUEST LECTURE 3

Chair: Prof. A. Muyot (Philippines-DLSU)
Vice Chair: Prof. L. Ramirez (PhilippinesTUP)

- STATE-OF-THE-ART OF R&D ACTIVIITES IN THE METAL INDUSTRY IN THE PHILIPPINES
  Engr. Rolando T. Viloria
  Director, Metals Industry Research and Development Center

08:40-10:00

SESSION 7A: FLUID MECHANICS

Chair: Dr. A. Elepaño (Philippines-DLSU)
Vice Chair: Prof. M. Kimura (Japan-NU)

- A COMPARATIVE STUDY OF ENTRAINMENT FLOW PARAMETERS WITHIN THE TEST SECTION OF SUBSONIC OPEN TYPE AND CLOSED TYPE WIND TUNNEL
  A. Mazumdar (India) - Jadavpur University

- PERFORMANCE ENHANCEMENT OF HEAT EXCHANGER USING SECONDARY FLOW EFFECTS
  T. Chandratilleke, (Australia) - Curtin University of Technology

- GASIFICATION OF HIGH MOISTURE ORGANIC WASTES: MODELLING AND DESIGN CONCEPTUALIZATION STUDY
  F. Vuluan, H. Kim, (Korea) - Korea University

- THE STABILITY OF THE FRONT STAGNATION POINT OF HILL'S VORTEX TO A SMALL THREE DIMENSIONAL DISTURBANCE
  T. Rozi (Japan) - Tokyo Denki University

SESSION 7B: STRENGTH OF MATERIALS

Chair: Prof. J. Cariaga (Philippines.-UP)
Vice Chair: Prof. R. Hizon (Philippines-TUP)

- GEOMETRICAL NONLINEAR BENDING PROBLEMS OF THE STRIP FABRICATED FROM THE MULTI-LAYERED COMPOSITE MATERIAL WITH PERIODICALLY CURVED STRUCTURES
  N. Yahnioglu, S. Selim, (Turkey) - Yildiz Technical University

- NUMERICAL MODELLING OF CERAMICFORMING PROCESS
  F. Chinesta, R. Torres, A Poitou, I. Monton, G. Racineux (Spain) - Universidad Politecnica de Valencia

- MECHANICAL PROPERTIES OF ELECTRON BEAM WELDED JOINTS OF MAGNESIUM ALLOYS
  T. Asahina, H. Tokisue (Japan) - Nihon University

- STATIC AND DYNAMIC ANALYSIS OF COMPOSITE PLATES WITH DIFFERENT BOUNDARY CONDITIONS
  M. Darvizeh, A. Darvizeh, K. Malekzadeh, (Iran) - Gilan University

- STUDY ON THE RESIDUAL MOMENT OF A CIRCULAR PLATE WITH A HOLE
  H. Homma, Y. Kato, T. Nishimura, H. Watanabe, (Japan) - Nihon University

SESSION 7C: MATERIAL SCIENCE

Chair: Prof. P. Herrera- Franco (Mexico-UM)
Vice Chair: Dr. F. Gaa (Philippines-UP)

- BORE-EXPAND TESTING OF ALUMINUM AND COPPER ALLOY SHEETS AT HIGH TEMPERATURES
  M. Sugamata, T. Iwata, J. Kaneko, (Japan) - Nihon University

- ASPECTS ABOUT THE INFLUENCE OF THE MAGNETIC FIELD ON THE BEHAVIOR OF A LOW-ALLOYED STEEL IN FATIGUE
  P. Livin, C. Sorin, (Romania) - University "Dunarea de Jos" of Galati

- THE EFFECT OF CARBON CONTENT AND INTERCRITICAL TEMPERATURE ON THE MECHANICAL PROPERTIES OF DUAL-PHASE STEELS
  E. Hamzah, Q. Aik, (Malaysia) - Universiti Teknologi Malaysia

- INVESTIGATION AND LESSENING OF SURFACE HEAT DAMAGE FOR CARBON/EPOXY WITH THE EDM PROCESS
  J. Huang (Taiwan) - National Huwei Institute of Technology

- TRENDS OF HEAT RESISTANT COMPOSITES RESEARCH IN JAPAN
  M. Morita (Japan) - Toyama Prefectural University

10:20 – 12:00

SESSION 8A: DYNAMICS AND ROBOTICS

Chair: Dr. M. Hernandez (Philippines-UP)
Vice Chair: Prof. T. Sekine (Japan-NU)

- THE CONTROL ANALYSIS OF UNICYCLE ROBOT
  M. Tamura, M. Okano, (Japan) - Nihon University
- AN INVESTIGATION INTO THE STICK-SLIP EFFECT OF PNEUMATIC ACTUATORS
  G. Lim, P. Chua (Singapore) - Nanyang Technological University
- A STUDY OF VIBRATION INTENSITY MEASUREMENT IN PLATES
  M. Nakajima, M. Okano (Japan) -Nihon University
- APPROXIMATING CARTESIAN STRAIGHT LINE PATH IN SCARA ROBOT JOINT SPACE USING CLOTHOID CURVES
  H. Makino, F. Salvador, (Philippines) De La Salle University
- ON EXPRESSION OF HUMAN BODY MOTION
  T. Sakata, T. Nishimura, Y. Wada, M. Itoh, (Japan) - Nihon University

SESSION 8B: STRENGTH OF MATERIALS

Chair: Dr. S. Claridge (UK-UP)
Vice Chair: Prof. H. Co (Philippines-DLSU)

- STUDIES ON CONE COUPLING
  H. Maki, U. Abla, (Japan) - University of Tokyo
- MECHANICAL MODELLING OF THE SUPERELASTIC ARCH-WIRE USED IN ORTHODONTIC TREATMENTS
  F. Chinesta, A. Ramon, M. Alcaniz, R.Torres, Monton, (Spain) - Universidad Politecnica de Valencia
- THE DYNAMIC RESPONSE OF ELASTO-PLASTIC BODY BY FORCED VIBRATIONS
  T. Nishimura, K. Matsushima, (Japan) - Nihon University
- EXPERIMENTAL VERIFICATION OF PLASTIC FLOW RULE
  S. Takeda, T. Nishimura, (Japan) -Nihon University
- STUDY ON BAUSCHINGER EFFECT UNDER MULTIAXIAL LOADING
  Y. Furukawa, T. Nishimura, (Japan) Nihon University

SESSION 8C: MATERIALS SCIENCE

Chair: Prof. M. Yoda (Japan-NU)
Vice Chair: Dr. J. Filho (Philippines -DOST)

- LAHAR-CLAY MIXTURE AS INCINERATOR-BRICK
  L. Aguila (Philippines) - Technological University of the Philippines
- THE NATURE OF MICROSTRUCTURE OF MNBRONZE
  L. Aguila (Philippines) - Technological University of the Philippines
- ON THE DETERMINATION OF THE THEORETICAL STRENGTH LIMIT IN COMPRESSION OF VISCOELASTIC UNIDIRECTIONAL COMPOSITE MATERIALS
  S. Akbarov, A. Cilli , (Turkey) - Yildiz Technical University
- ON THE EDGE EFFECT OF COMPOSITE MATERIALS
  Z. Suyocok, A. Suyocok, (Turkey), Yildiz Technical University
- NON-DESTRUCTIVE ULTRASONIC PULSE-ECHO METHOD DETERMINATION OF BULK WAVE VELOCITIES AND ELASTIC MODULI IN METAL-MATRIX COMPOSITES
  R. Nunez, M. Mena, (Philippines) - University of the Philippines

12:00 LUNCH BREAK

13:00 – 14:40

SESSION 9A: DYNAMICS AND ROBOTICS

Chair: Prof. G. Lim (Singapore-NTU)
Vice Chair: Prof. V. Angeles (Philippines-TUP)

- DYNAMIC ANALYSIS OF CABLE-MEMBRANE STRUCTURES WITH SLACKENING MEMBERS
  Y. Miyazaki, Y. Nakamura (Japan) - Nihon University
- A PICK AND PLACE INSTRUCTIONAL PURPOSE ROBOT ARM WITH NEWLY DESIGNED MULTI-MOVEMENT MECHANISM
  F. Argamosa, M. Dakanay, (Philippines) Technological University of the Philippines
- FINITE ELEMENT ANALYSIS OF A PQFP PRINTED CIRCUIT BOARD ASSEMBLY
  P. Fok, F. Yap, Q. Yang, G. Lim, (Singapore) - Nanyang Technological University
- INTELLIGENT SYSTEM TECHNOLOGIES FOR CONTROL OF A WALKING ROBOT
  R. Atienza, M. Ang, Jr. (Singapore) - National University of Singapore
- NEURAL NETWORK APPLICATION TO PATTERN RECOGNITION
  E. Dadios, (Philippines) - De La Salle University

SESSION 9B: STRENGTH OF MATERIALS

Chair: Dr. A. Hashimoto (Japan-NU)
Vice Chair: Engr. A. Marño (Philippines.-DOST)

- STRUCTURES AND MECHANICAL PROPERTIES OF FRICTION WELDED JOINTS OF AZ31 MAGNESIUM ALLOY TO SUS 304 STAINLESS STEEL
  K. Katoh, H. Tokisue, (Japan) - Nihon University
- THE FATIGUE INTEGRITY OF LOAD-HAUL-DUMP MINING MACHINERY
  S. Claridge, V. Ignatov, T. Oliver (United Kingdom) University of Portsmouth
- EFFECTS OF RESIDUAL STRESS ON FRACTURE TOUGHNESS AND SUB-CRITICAL GROWTH OF INDENTED CRACKS IN VARIOUS GLASSES UNDER TENSILE AND BENDING STRESSES
  M. Yoda, T. Tsutsumi, N. Yasumoto (Japan) Nihon University
- FRACTURE AND CREEP CRACK GROWTH CHARACTERISTICS IN POLYMER FILM
  M. Yoda, M. Nabetani, (Japan) - Nihon University

SESSION 9C: ENGINEERING EDUCATION

Chair: Dr. E. Tadeo (Phils.-TUP)
Vice Chair: Dr. M. Okano (Japan-NU)

- MECHANICAL ENGINEERING EDUCATION IN THE PHILIPPINES:ASSESSMENT, REFORMS AND FUTURE DIRECTIONS
  M. Belino (Philippines) - De La Sallie University
- COMPREHENSIVE ANALYSIS OF THE MECHANICAL ENGINEERING CURRICULUM OF DE LA SALLE UNIVERSITY
  G. Patron, (Philippines) - De La Salle University
- THE MECHANICAL ENGINEERING UNDERGRADAUTE THESIS PROGRAM AS AN OUTREACH PROGRAM: A DE LA SALLE UNIVERSITY EXPERIENCE.
  ME. Kalaw (Philippines - De La Salle University
- HUMAN FACTORS ENGINEERING: A NEW DESIGN AGENDA FOR MECHANICAL ENGINEERS IN THE THIRD MILLENNUM
  A. Velasco (Philippines) - De La Salle University

- PULL-OVER STRENGTH OF PROFILED STEEL CLADDING SYSTEMS
  L. Tang, M. Mahendran, (Australia) - Queensland University of Technology

- OFF-THE-JOB TRAINING EFFECTIVENESS
  P. Chinintron (Thailand) - Rajamangala Institute of Technology

14:40 COFFEE BREAK

15:00 SESSION 10A: DYNAMICS AND
16:30 ROBOTICS

Chair: Prof. N. Graza (Philippines.-TUP)
Vice Chair: Dr. Y. Miyazaki (Japan-NU)

- IMPACT CLOSURE OF PLANAR OPEN CHAINS
  S. Hazarika , S. Mukherjee, (India) - Indian Institute of Technology

- STUDY OF OPTIMUM RESULTANT FORCE IN INDIVIDUAL TIRES OF THE VEHICLE AT BRAKING IN TURN
  T. Sekine, H. Nagae (Japan) - Nihon University

- VISION ASSISTED SCARA (SELECTIVE COMPLIANCE ASSEMBLY ROBOT ARM)
  P. Lim, SB. Lim, E. Luna, K. Sotto, C. Syling, (Philippines) - De La Salle University

- SOME ENERGY AND POWER ANOMALY IN SIGNAL ANALYSIS
  A. Estalilla, (Philippines) - De La Salle University

- PICK AND PLACE REVOLUTE ROBOT ARM MOUNTED ON AN X-Y COORDINATE TABLE
  D. Abog, A. Ancheta, E. Guison, LV. Lukban, L. Serrano III, (Philippines) - De La Salle University

SESSION 10B: STRENGTH OF MATERIALS

Chair: Dr. A. Oreta (Philippines-DLSU)
Vice Chair: Dr. T. Asahina (Japan-NU)

- STABILITY OF COMPOSITE PLATE-STRIP HAVING PERIODICAL CURVINGS IN THE MATERIAL STRUCTURE
  Z. Kulug (Turkey) - Yildiz Technical University

- FRACTURE OF HOLLOW PLASTER CYLINDERS UNDER EXTERNAL PRESSURE
  A. Hashimoto, M. Terashima, Y. Sato, (Japan) - Nihon University

- STATISTICAL STRENGTH CHARACTERISTICS OF ALUMINUM ALLOY PIPE AND CARBON STEEL PIPE FRICTION WELDED JOINTS
  G. Kawai, K. Ogawa, R. Tsujiro, H. Tokisue, (Japan) - Osaka Sangyo University

- THE EFFECT OF MATERIAL STACKING SEQUENCE ON THE FRACTURE INSTABILITY OF A THREE (3) LAYERED COMPOSITE RESISTING THERMAL LOAD
  H. Co (Philippines) - De La Salle University

- BUCKLING ANALYSIS OF MULTI-LAYERED COMPOSITE TUBES SUBJECTED TO DIFFERENT TYPE OF LOADING WITH DIFFERENT BOUNDARY CONDITIONS
  A. Darvizeh, M. Darvizeh, K. Malekzadeh, (Iran) - Gilan University

- NON-LINEAR ANALYSIS OF DEPLOYABLE MEMBRANE STRUCTURE
  Y. Hirose, Y. Nakamura, Y. Miyazaki, (Japan) - Nihon University

SESSION 10C: GENERAL TOPIC

Chair: Dr. F. Gaa (Philippines-UP)
Vice Chair: Dr. M. Hoshino (Japan-NU)

- STUDY OF DRIVER'S EYE POINT AND RECOGNITION BEHAVIOR
  T. Kaiho, T. Sekine, H. Nagae, (Japan) - Nihon University

- TRAINING ROUTE TOWARDS MULTI-SKILLING
  E. Tadulan, J. Picar, M. Perfecto, (Philippines)- PHINMA Group Training, Co., Inc.

- CONCURRENT ENGINEERING: ANYONE?
  O. Unas, (Phiippines) - De La Salle University

- DEVELOPMENT OF CYLINDRICAL SHELL ELEMENT
  G. Naoe, Y. Nakamura, Y. Miyazaki, (Japan) - Nihon University

- DRIVING CYCLE FUEL CONSUMPTION SIMULATION
  G. Bautista (Philippines) - University of the Philippines

- FRICTION AND WEAR BEHAVIOR OF POLYMERS IN OSCILLATING MOTION (2ND REPORT)
  H. Takahashi, A. Saito, I. Um (Japan) Nihon Univeristy

16:30 **SESION 11: CLOSING CEREMONY**

Master of Ceremony: Nenet C. Graza, Technological University of the Philippines

****End of the conference****

ABSTRACTS

PLENARY SESSION LECTURES

(Day 1)

AEOLIAN TONES FROM TWO-DIMENSIONAL CYLINDERS

H. Fujita, JAPAN

Aerodynamic sound generated from cylindrical objects, such as in pantographs of trains, is a prime noise source in high speed vehicles. The objective of this paper is to understand the generation mechanism of the aerodynamic sound from two-dimensional cylinders. Basic theories for the aeroacoustics are reviewed at first. For the experimental investigations, structure of the low noise wind tunnel and proper model end plate construction are discussed. Control of the aerodynamic noise generated from two-dimensional circular and square cylinder is studied experimentally in a low noise wind tunnel. Power spectra of the radiated noise in various angles of inclination for a circular cylinder and angles of attack for a square cylinder are measured to examine the changes in peak levels and the Strouhal numbers of the so called Aeolian tones.

RECENT CHANGES IN ENGINEERING EDUCATION IN AUSTRALIA

W.W. S. Charters, AUSTRALIA

Over the last decade or so there have been substantial changes in engineering education within Australia. These include inter alia the effective liberalisation of course structures allowing more student freedom of choice, moves towards a self learning rather than a teaching process, increasing involvement of women in engineering, and greater internationalization of the student body and further emphasis on the inclusion in courses of management techniques such as communication skills and team working abilities (1).

A major study commissioned in "Engineering Education into the Future" which emphasizes a major change in educational culture was completed in Australia in 1996 and published in three volumes in 1997.

Since 1980, at the behest of the Institution of Engineers, Australia, all accredited Bachelor of Engineering are of four years duration post Year 12 at Secondary school. Several para professional qualifications called Bachelor of Technology have evolved on a three year basis, some of which are clearly specialist courses and others of more general engineering focus.

Student pressure for broader education has encouraged the evolution of a particularly Australian phenomenon - the combined degree structures. These degrees allow the students to gain double qualifications such as B. Eng/B.A with humanities and languages, B.Eng/B. Comm, with emphasis on economics and commerce, or B.Eng/B.Sci with an even stronger science favour the most than most straight four year engineering degrees. Each of these combined degrees takes five years of full time study with the eventual award of two degrees. A recent addition is LLB/B.Eng with the Law Faculty which takes six years of full time study to satisfy both professional institutions.

GUEST LECTURES

(Day 2)

FORMING PROCESSES MODELLING INVOLVING MOLTEN SHORT FIBERS COMPOSITES: STATE OF THE ART AND RECENT DEVELOPMENTS

F. Chinesta, A. Poitou, R. Torres, I. Monton, F. Meslin, SPAIN

Modeling flow induced orientation of short fibers reinforced thermoplastics is of major interest in composite processing. It permits both to avoid orientation defects and to define the mechanical behaviour of the composite, which is known to be strongly coupled with the fiber orientation. This modeling is commonly achieved in the framework of dilute or semi-dilute suspensions of non-spherical particles in a Newtonian fluid. The resultant equations involve an elliptical boundary value

problem coupled with a convection type equation. The elliptic problem is associated with the equilibrium equations whereas the convection equation describes the time evolution of the anisotropic viscosity tensor.

The second problem entails two difficulties: it is non linear and hyperbolic. Therefore, it is not possible to apply the common Galerkin formulation, which is inefficient to solve convection problems. In this paper, we analyze different techniques to obtain numerical solution of the steady convection equation, standing out the advantages and the difficulties of each one.

Finite volumes or discontinuous Galerkin finite element techniques will be compared with the method of characteristics and it will be explained why the now classical fully coupled methods (which have proved their efficiency for viscoelastic fluids) cannot be applied here straightfully for composites.

Once the local alignment of the fibers with the flow has been theoretically proved to be the only solution in the recirculating parts of the flow, and moreover being this solution stable, we will see that the variational methods are able to produce spureous solutions in these flows, in contrast with the solutions obtained by the method of characteristics.

In conclusion, a technique which combines the integration of the orientation equation by the method of characteristics in the non-circulating part of the flow and takes into account the local alignment of the fibers in the recirculating part, will prove to be a technique well adopted to the discretization of the orientation equation in flows with these properties.

SMART STRUCTURES AT NTU

A. Asundi, SINGAPORE

Smart structures is a rapidly advancing field with the range of support and enabling technologies having made significant advances, notably optics and electronics. Whilst piezoelectric actuators and fiber optic sensors have been accorded the most attention, other techniques such as Shape Memory Alloys, Magneto Restrictive Materials and Electro-Rheological Fluids also have niche applications. Furthermore, aspects such as structural integrity, sensor fusion and data interpretation are being considered. This paper will describe some of the research activities at NTU encompassing this broad range of strategic activities.

STATE-OF-THE ART OF R&D ACTIVITIES IN THE METALS INDUSTRY IN THE PHILIPPINES

R. T. Viloria, PHILIPPINES

The current state of the metal industry is reviewed. The state of the affairs in the industry is linked to the stages of the development of the country vis-a-vis other countries of the world. In terms of global competitiveness, the Philippines ranked 32nd among the 46 competitive economies, 44th in terms of R&D expenditures; and 32nd in tems of overall S&T standings. While South Korea, a leading exporter of metal-based consumer and heavy industry products allots 2.23 % of that country's GNP to R&D, the Philippines spends only an equivalent amount to 1.21% of GNP. This coupled with other challenges such as the country's R&D structure, institutional arrangements and certain policy issues are exerting pressures in various R&D projects designed to enhance the metals industry's global competitiveness.

ENGINEERING EDUCATION

MECHANICALENGINEERING EDUCATION IN THE PHILIPPINES: ASSESSMENT, REFORMS AND FUTURE DIRECTIONS

M.C. Belino, PHILIPPINES

Mechanical Engineering is one of the more popular traditional engineering courses in the Philippines. About 3,500 students graduate each year with a bachelor 's degree in mechanical engineering. Though the Philippine engineering schools graduate far too many engineers than what the present economy can accommodate, the prospect of employment in the ASEAN region is very positive since one of APEC's agenda is the mutual recognition of engineering qualifications. It is imperative, therefore, that a periodic assessment of the mechanical engineering educational program be done to ensure the supply of quality mechanical engineers to feed both the local and global markets. Such assessment should lead to reforms in the educational program such as curricular improvement and introduction of majors or areas of concentration and should provide inputs in setting the future directions of mechanical engineering education.

This paper discusses the process of assessing the quality of mechanical engineering program in the Philippines specifically the private voluntary

accreditation process of the Philippine Accrediting Association of Schools, Colleges and Universities (PAASCU) and the Peer Evaluation Process (PEP) of the Foundation for Engineering Education Development (FEED) which includes an expert from the industry sector aside from academics in its peer evaluation team; the periodic review process by the government Commission on Higher Education - Technical Panel for Engineering, Architecture and Maritime Education (CHED-TPEAME) which set the curricular guidelines for engineering schools in the Philippines; and the role of the professional societies such as the Philippine Society of Mechanical Engineers (PSME) and the Philippine Institute of Mechanical Engineering Educators (PIMEE) in the continual improvement of the mechanical engineering program.

Thus, the tasks of assessing, reforming and setting the future directions of the mechanical engineering education in the Philippines is a multisectoral effort of the academia, government, industry and professional society.

AN IN-DEPTH EVALUATION OF THE MECHANICAL ENGINEERING CURRICULUM OF DE LA SALLE UNIVERSITY

G.I. Patron, PHILIPPINES

This paper covers an extensive evaluation of the mechanical engineering education at De La Salle University in Manila, Philippines Comparison is made of a typical four plus years (12 to 14 terms) of engineering education in a typical engineering institution in the Philippines. Coverage include course evaluations and comparison of similar courses given by western universities with suggestions given to update curriculum if needed, maintain, drop or decrease emphasis of some to determine if the curriculum meets the technological criteria set by the government of the Philippines for a continuous improvement of engineering education as we approach the year 2000.

THE MECHANICAL ENGINEERING UNDERGRADUATE THESIS PROGRAM AS AN OUTREACH PROGRAM: A DELA SALLE UNIVERSITY EXPERIENCE

M.E.L. Kalaw, PHILIPPINES

Over the course of the fifty years of the mechanical engineering program in De La Salle University (DLSU), research in the undergraduate mechanical engineering program has gone through several directions already. There have been some bright moments but they are mostly flashes of light reflected from Gold Medal for Best Thesis awards which are then forgotten. But some have gone outside the confines of the college onto solid ground and are now of practical use to certain communities. This transpiration is not incidental, for at present, to a certain extent, it can be said that the DLSU ME undergraduate thesis program has taken on a social responsibility.

This paper discusses the experience of the DLSU ME department in actualizing this social responsibility through its undergraduate thesis program becoming a venue for extending technical assistance to certain communities, particularly those in the rural and sub-urban areas. It assesses the strengths and peculiarities of the mechanical engineering department (both faculty and students) for such extension work and how they can improve the effectivity and increase the reach of the program. Further, the paper gives an evaluation of how this program supports DLSU's mission in developing whole persons as quality engineers. The by-line has been to train engineers according to the needs of industry, this can be done yes, and much more.

HUMAN FACTORS ENGINEERING: A NEW DESIGN AGENDA FOR MECHANICAL ENGINEERS IN THE THIRD MILLENIUM

A.L. Velasco, PHILIPPINES

This paper presents the concept of incorporating human factors engineering in the design considerations for mechanical engineering design discipline. The present trend in the international competition on product innovation should be taken seriously for an organization to maintain growth and profitability. Innovation is an accepted factor for an organization to gain competitive advantage. Product design being the forerunner of innovation should not only consider technology but the environment where technology will be used. The most influential factor in this environment is the human resource or its human user.

This paper aims to examine the scope of human factors engineering contribution to the product design process and the basic assumptions used in the user interface design. Examples of emerging developments on product design incorporating human factors are also presented.

Implications of human aspect considerations in design are also discussed. From these factors, two recommendations are explored by the paper namely: (a) human factors considerations should be imbedded in the early part of the design process and (b) mechanical engineering program should include in their basic course requirements human factors engineering for better inclusion of human aspects in the design process.

OFF THE JOB TRAINING EFFECTIVENESS

P. Chinintron , THAILAND

An assessment of the worthiness of a training program poses difficulty. Participation in a training of a particular topic conducted by an outside training agency often draws people from different background and training needs. The assessment of training effectiveness based on information collected immediately after the training session purportedly to give feedback information on the training is of dubious value for a course improvement. Information provided after a period of working after training ought to provide more realistic transfer of training and hence its effectiveness. This research made a follow up study of participants on a two-day training session for technicians on the topic of the maintenance of hydraulic and pneumatic equipment using mail questionnaires. The objectives of the study were to ascertain the satisfaction from the training and its usefulness of what were learnt for the job. Sixty-four participants completed the questionnaires. The study found that despite different background and familiarity of equipment, participants made satisfactorily transfer of training to the job. However, participants had difficulties applying what they learned about the making of maintenance policy and planning. Another area of difficulty was the application of troubleshooting methodology. Incidentally, when asked the area they needed further training, these two areas appeared often. Training for transferring to the job on these two main topics were worth contemplating.

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MATERIAL SCIENCE

THE EFFECT OF CARBON CONTENT AND INTERCRITICAL TEMPERATURE ON THE MECHANICAL PROPERTIES OF DUAL-PHASE STEELS

E. Hamzah, Q. Boon Aik, MALAYSIA

Dual-phase steel was developed to satisfy an increasing need, primarily in automotive industry, for new high strength steel which permits weight reduction without sacrificing formability or dramatically increasing costs. Dual-phase steels have unique properties such as continuous yielding behavior, a high tensile strength and high ductility.

This paper will discuss on the effect of heat treatment on tensile and fatigues properties of low carbon dual phase steel. Locally produced steel samples of composition 0.12%C, 0.45%Mn, 0.15%Si, 0.17%Cr were heat treated to produce two different prior microstructures, namely ferrite-pearlite and martensite. Each of these samples was intercritically annealed at temperature range of 730 C to 830 C followed by water quenched. Quantitative metallography was used to calculate the volume fractions of martensite and ferrite phases present at each temperature. The intercritical annealing temperature which produced approximately 20% martensite and 80% ferrite was then determined.

Tensile properties were determined using Instron Universal Testing Machine. Both yield and tensile strength values were used to predict the fatigue limit and cycles of S/N curve. Actual fatigue test was carried out using Dartec Hydraulic Universal Testing machine. It was found that dual-phase steels have superior tensile and fatigue properties compared to the conventional and untreated steel of ferrite-pearlite microstructures. Fractographic studies show that the steels failed both in ductile and brittle manner. This indicates that both the soft ferrite and hard martensite phases play an important role in the plastic deformation of the steel.

ASPECTS ABOUT THE INFLUENCE OF THE MAGNETIC FIELD ON THE BEHAVIOR OF A LOW-ALLOYED STEEL IN FATIGUE

P. Livin, C. Sorin , ROMANIA

This paper presents the influence of the magnetic field on the behavior of a low-alloyed steel

for variable loading and in air and in corrosive environment (water solution with 3% NaCl).

The author has done fatigue tests for plane bending (the sample being rotated and made of the above-mentioned steel). The tests were carried out both in air and in corrosive environment for increasing step-by-step level of the magnetic field.

The influence of the magnetic field on the fatigue limit was appreciated analysing the following aspects:

- the influence of the variation of the magnetic field on the fatigue limit in air and on the conventional fatigue limit in the corrosive environment, respectively;
- the influence of the magnetic field on the evolution rate of the fatigue crack;
- the influence of the magnetic field on the structural changes (dislocation density, internal stresses of second order).

The researches show that the fatigue limits both in air and in the corrosive environment increase as the magnetic field increases. There is a limit in increasing the magnetic field under that its influence on the behavior in variable loading is favorable. It was noticed that the magnetic field influences the behavior in variable loading mostly by the effect on the mechanisms of dislocation displacements. The appearance of the micro-damage process within the superficial layer of the pieces subjected to fatigue, is delayed having good effects on the fatigue limit. In the corrosive environment, the effects of the magnetic field manifest more intensely as compared to the tests carried out in air.

The constant magnetic field has a favorable influence on the fatigue behavior of a low-alloyed steel by delaying the damaging processes within the superficial layer.

The influence of the magnetic field manifests at macroscopic level by the magnetostrictive phenomena and at the microscopic level by effects on the dislocations' mobility.

TRENDS OF HEAT RESISTANT COMPOSITES RESEARCHES IN JAPAN

M. Morita , JAPAN

A brief review of recent developments of heat resistant composites in Japan will be presented.

Composite materials are, as they are so called tailored materials, highly need oriented materials. That is, they are designed and manufactured after the society's needs. One of the needs in Japan was to develop high performance heat resistant composites for space planes and also for new energy generations.

MITI promoted two projects to develop composites as heat resistant materials. They were R & D Project of Basic Technologies for Future Industries (BTFI) and the Industrial Science and Technology Frontier Program (ISTF). In the former project, continuous carbon fiber-reinforced aluminum, silicon carbide fiber-reinforced Al and Ti alloy were developed. These FRM'S were aimed to be used up to 450° C. And in the latter, SiC/IMC composites and C/C composites were investigated to be used at higher temperatures range.

Preventing oxidation was one of the most important problems to be solved for heat resistant materials used in the air, and many multi-phase coating systems were tried. But they are still continuing research.

Composite researches' next interests seem to be in intelligent materials. For aeroplanes, smart structures are developed as self-health monitoring systems. For the ideal materials system, self-healing materials is desired eagerly. PMMA was fond that it had a king of self-healing characteristics.

And also, non-structural uses of MMC will be introduced briefly.

INVESTIGATION AND LESSENING OF SURFACE HEAT DAMAGE FOR CARBON/EPOXY WITH THE EDM PROCESS

J. Huang, TAIWAN

After carbon/epoxy laminates were machined with electro-discharge machining, two kinds of machined faults were observed. One of the faults is a heat damage zone in which the reinforced fibers lose the protection of the matrix at the upper surface, the other is debonding at the lower surface. These will result in significant loss of strength and destroy the structural integrity. This paper develops a method to improve the faults. In this method, copper plates are temporarily glued to the upper and the lower surfaces of the specimens. The upper plate acts to transform the free-surface laminates to the inside so slowing the spread of spark-machined heat

as to reduce the heat damage zone. The lower plate acts as a support to prevent debonding. To predict the size of the heat damage zone in any direction with respect to fiber orientations, a one-dimensional heat transfer equation was invoked. Comparing the experimental results of round and square holes machining under various pulse-on time, the one-dimensional model provided a simple qualitative analysis.

HDPE-HENEQUEN FIBER INTERPHASE CHARACTERISTICS-INFLUENCE OF FIBER TREATMENT ON MECHANICAL PROPERTIES

A. Valdez-Gonzales, M. Cervantes-Uc, P.J. Herrera-Franco, MEXICO

The use of thermoplastic polymers with natural short-fiber reinforcement has grown rapidly because of their good processability and their ability to be recycled. The hydrophilic nature of the lignocellulosic fibers limits its use with hydrophobic matrices due to a strong incompatibility. In order to assure appropriate interfacial interaction, their surface properties must be modified accordingly. In this work the surface topography of Henequen fibers (Agave fourcroydes) was modified using an alkaline treatment, which increased the fiber roughness. Then the fibers were treated with a silane-coupling agent, that promoted the fiber-matrix adhesion through chemical interactions and together with a pre-impregnation process that enhanced the mechanical interlocking. In order to measure the interfacial shear strength (ISS) and to find out the influence of the fiber surface treatment over the fiber-matrix interphase characteristics, two single fiber tests were used the fragmentation test and the pull-out test. The preliminary results showed that the henequen-HDPE interphase posseses a non-linear ductile material behavior regardless of the fiber surface treatment whereas the strength of the fiber-matrix interphase depends strongly on it.

ON THE DETERMINATION OF THE THEORETICAL STRENGTH LIMIT IN COMPRESSION OF VISCOELASTIC UNIDIRECTIONAL COMPOSITE MATERIALS

S. Akbarov, A. Cilli, TURKEY

Up to present, the theoretical strength limit in compression of unidirectional composite materials has been studied in the framework of the continual approach according to which these materials with piecewise-constant properties are modeled by a structurally homogeneous orthotropic medium with normalized characteristics. After this procedure, the three-dimensional linearized stability equations (TDLSE) are written for this homogeneous orthotropic infinite body under the action of external compressive forces. In case , the condition of ellipticity of the TDLSE are not satisfied and these equations lose their ellipticity, then it is assumed that the fracture of the considered materials occurs. Moreover, in these cases the values of the external forces corresponding to the type change of the TDLSE are accepted as the theoretical strength limit in compression of the considered unidirectional composite material.

Note that under studying of the above problems it is assumed that the precritical stress-strain state is homogeneous and the mechanical properties of the considered composites are time-independent. Taking into account of the above-stated in the present paper the approach for the investigations of the theoretical strength limit in compression for the linear viscoelastic unidirectional composite materials are proposed. In this case it is assumed that in the structure of the considered composite material , there are some local curvings of the reinforcing layers of fibers. Using the method proposed in Akbarov, et al (1997) the stability loss in the structure of this composite material is examined and it is proved that the critical time corresponding to the stability loss in the structure of the considered material under compression of that with constant external compressive forces is just the theoretical strength limit of that.

The investigations are carried out in the framework of the piecewise-homogeneous body model with the use of the geometrical non-linear equations of the theory of viscoelasticity.

MICRO BIOLOGICALLY ASSISTED FATIGUE CRACK GROWTH BEHAVIOR OF STAINLESS STEEL UNS S31603 IN TROPICAL SEA WATER

N. Acuna-Gonzalez, G. Delorme, P. Herrera-Franco, MEXICO

Marine structures such as bridges, piers, oil platforms and others are subjected to the effect of exposure to a very harsh environment. It is known that a structure that is undergoing cyclic loading is susceptible of suffering a fatigue failure when a crack propagates and finally develops into a fracture. The action of the waves, concentration of dissolved salts, the action of the marine consortia of microorganisms

and sometimes, the presence of different pollutants contribute synergistically to the deterioration of such structures where the mechanical failure is enhanced. The microorganisms that attach to the metal surface played a determinant role on the mechanical strength of metallic structures, promoting dissolution of the passive film and pits nucleation. Pits behaved as stress risers, where a fatigue crack could be initiated. It has been observed that crack propagation is initiated earlier in natural sea water than in artificial sea water because of the presence of microbial activity which reduces the Kth values. In this paper, we present a study of the observed microbial activity and its effect on the increase of the fatigue crack growth rate. Such activity modified the chemical and electrochemical conditions near the crack tip thereby reducing the Kth values at corrosion potential conditions. It was also observed that cathodic protection did not aid significantly in the fatigue crack arrest in spite of the formation of calcareous deposits inside the crack. The presence of microorganisms was corroborated by Scanning Electron Microscope analysis on the fracture failure surface of steel.

NONDESTRUCTIVE ULTRASONIC PULSE-ECHO METHOD DETERMINATION OF BULK WAVE VELOCITIES AND ELASTIC CONSTANTS IN METAL- MATRIX COMPOSITES

R. C. Nunez, M. G. Mena, PHILIPPINES

A *nondestructive pulse-echo* method is utilized to obtain the parameters known as the *bulk wave velocities* and *elastic constants* in a magnesium-silicon alloyed aluminum material. Due to its high strength-to-weight ratio characteristics that is essential in low-temperature aerospace applications, the same parameters are also acquired in a composite which is derived from the same alloy as its matrix and reinforced with ceramic silicon-carbide particulates. *Mechanical* destructive *fatigue* tests are also adopted in order to determine the behavior of the abovementioned parameters in these materials at three different states, namely - *pre*-fatigue, *in*-fatigue and *post*-fatigue states. The comparison of the results that are obtained from the nondestructive and destructive test techniques employed in this work will be discussed.

THE NATURE OF MICROSTRUCTURE OF MANGANESE BRONZE

L.G. Aguila , PHILIPPINES

Copper is alloyed with minor quantities of other metals to increase the strength and hardness of the final product. In this study, manganese is alloyed with copper to from what is defined here as Mn-bronze. The purpose of the study is to characterize the changes in the microstructure of the alloy after a precipitation hardening process on two sets of alloy compositions, 20% Mn balance Cu and 30% Mn balance Cu, was done. The alloys were melted in air. specimens were originally cast as cylindrical rods 22mm in diameter. They were later machined to cylindrical bars, 3/4 in diameter and 1/2 in long. They were all homogenized for 1 hr at 800°C and quenched in ice cooled water. Samples were heat treated at three temperatures, 200 300 and 400C at various heating times, 1,2,4 and 8 h. The study showed the following : the alloys are generally made up of a single phase, solid solution of alpha + gamma; there is general decrease in the size of precipitated grains with increasing heating time; and grain size increases with increasing heat treatment temperature;. The study suggests that in addition to transformation hardening, age hardening may likewise be performed to affect and improve the mechanical and physical properties of Mn-bronze.

LAHAR-CLAY MIXTURE AS INCINERATOR BRICKS

L. G. Aguila, PHILIPPINES

Clay has long been used as body and/or binding material in the production of ceramic materials including bricks. This study concerns the effect of limited amounts of lahar on certain mechanical properties of clay bricks, especially shrinkage and compressive strength. A 3 by 3 by 3 factorial experiment was run. The study focused on three mix compositions, 10%, 20% and 30% lahar balance clay by weight; three grain sizes, -50 mesh - 100 mesh and -200 mesh; three compaction loads, 1,2 and 5 tons; and, three firing temperatures, 700, 900 and 1100 C. Bricks consisting of 2000 g of the mixture and 200 ml of water were formed in mold with inside dimensions of 220 mm in length and 100 mm in width. The study showed that shrinkage is independent of composition, grain size, amount of compaction and firing temperature; that only firing temperature has proportional effect on the brick's compressive strength; generally, bricks of medium grain size (-100mesh) registered the highest values of

compressive strength. The bricks did not exhibit cracking or baking even at firing temperature of 1100C, the maximum temperature inside incinerators. The highest compressive strength of 388 kg/cm² is higher than that measured (by the DOST) for pure clay, a condition attributed to compaction. In conclusion, the lahar-laced clay bricks can be utilized as incinerator linings. The study added another way to maximize the benefits from Mt. Pinatubo lahar.

BORE-EXPAND TESTING OF ALUMINUM AND COPPER ALLOY SHEETS AT HIGH TEMPERATURES

M. Suganuma, T. Iwata, J. Kaneko, JAPAN

High temperature formability in stretch-flanging of aluminum and copper alloy sheets has been studied by bore-expanding tests. Formability tests were carried out by using an experimental apparatus in which a blank sheet, die and punch were heated uniformly at temperatures between RT and 723K. Fully annealed aluminum alloys (JIS: A 110, A3004, A5052, A5182) and copper alloys (JIS: C1100, C2200, C2600, C2801) were used as the test materials. The influence of the shape of punch head on bore-expansion was investigated by using flat, spherical and cone shaped punches. Tensile properties of testing sheets were obtained at each testing temperature. Limiting bore-expanding ratio (LBER) of aluminum alloy sheets increases with testing temperature, whereas that of copper alloy sheets decreases . It is shown that LBER values at various temperatures are correlated to the tensile elongation. Although LBER values of tested sheets varied with the shape of punch head, relationship between LBER and testing temperature is shown to be relatively the same for three kinds of punch head. Thus, change of formability in stretch-flanging of sheets with rising temperature can be evaluated by using any of punch head.

ON THE EDGE EFFECT OF COMPOSITE MATERIALS

A. Soyucok , Z. Soyucok, TURKEY

It is considered the half plane reinforcing with a single semi-infinite layer and it is supposed that at the edge of the reinforcing layer the self-equilibrium continuously distributed-symmetrical normal forces act. In the framework of the piecewise-homogenous body model with the use of the exact equations of the linear theory of elasticity the plane strain state is studied. The boundary conditions at the edges are satisfied exactly and studying of the problem is reduced to the solution of the system of two singular integral equations which can be solved in principle.

GENERAL TOPICS

TRAINING ROUTE TOWARDS MULTI-SKILLING

E.L. Tadulan, J.A. Picar, M.C. Perfecto, PHILIPPINES

The economic crunch in the Asian region has affected almost every industry. Each industry is now looking for every section where cost can be reduced. Industries relying heavily on the use of power have decided to mothball their plants. Many have resorted to human resource downsizing or smart sizing.

Smart sizing option is the careful selection of limited number of plant personnel to run the operation. Consequently, these personnel will have an increased area of responsibility and require higher level of skills. These newly required skills can be acquired through proper training.

Programme for training must be developed to address different issues to include: the flexibility of the worker to adopt new or additional knowledge, the relevance of training course to the present work environment and the increase in productivity as a result of training.

Multi-skilling is the term used for a process of acquiring multiple skills to improve productivity. In this paper, the process of multi-skilling as applied in the PHINMA Group of companies will be described. It is envisioned that after a year or two, a considerable number of workers in the PHINMA Group will have two or more skills, a model in training and development that might also be effective in other organizations.

STUDY ON DRIVER'S EYE POINT AND RECOGNITION BEHAVIOR (BEHAVIORAL CHANGE OF POINTS OF VIEW WITH/WITHOUT SUB TASK)

T. Kaiho, T. Sekine, H. Nagae, JAPAN

Genarally speaking, driver's environmental situations change so rapidly and arbitrarily that it is

very difficult to investigate the driver's behavior of identification, prediction and decision making. The authors performed the experimental study to find out the mental behaviors of driving, especially focusing to behavior of points of view and response.

This study was carried out by the so-called the vision response test in which the test subject of driver pursues indicated marks on the computer display. At the same time, the subject had to perform mental calculations of additions, which consist of one, two, and three-digit numbers as optional mental tasks.

The display surface is divided into 25 sections (vertically and horizontally in 5 sections each), the subject must move the mouse cursor on the indicated mark and click as quickly as possible after recognizing the indicated mark.

The behavior of the subject revealed as follows. When the mark is indicated, the point of view starts to move to catch up the mark, and then make fine-tuning. After the mouse cursor stops moving, the point of view starts to tremble until the subject will complete to click the target.

The mechanism of point of view behaviors and the responses of subject's action are discussed referring to the driving behaviors of identification, judgement, decision and execution.

FRICTION AND WEAR BEHAVIOR OF POLYMERS IN OSCILLATING MOTION (2ND REPORT) - INFLUENCE OF PTFE CONTENT FOR PEEK

H. Takahashi, A. Saito, I. Um, JAPAN

In the previous report, the friction and wear behavior for polyoxymethylene (POM), high density polyethylene (HDPE) and polyamide (PA) in oscillating motion (OM) were reported. The behavior is dependent on mechanical properties of polymetric materials. There are two types of the behavior, one is a lot of wear volume but a bit of the deformation of specimen for POM and another is a bit of wear volume but a lot of deformation of specimen for HDPE.

DEVELOPMENT OF CYLINDRICAL SHELL ELEMENT

G. Namae, Y. Nakamura, Y. Miyazaki, JAPAN

In this study, to decrease the deformation of specimen, the polyethere a finite element of cylindrical shells is developed, and linear and nonlinear deformation of an elastic tube is analyzed. Tubes are flexible, in light, and available for space structure, e.g. manipulators, inflatable structures, and so on. Finite element method is suitable for the analysis of such deformation. In the finite element analysis, shell elements, such as four, eight, or nine nodes isoparametric shell elements, are generally employed. However in order to simulate large deformation of the tube, the tube model must be divided into a lot of small elements. This method results in increase of degree of freedom. Therefore the reduction of the degree of freedom with appropriate numerical accuracy is required to save the computational time.

In this paper, we propose a cylindrical shell element. The whole system of the tube is divided into finite number of cylindrical shells. The displacement of the cross section is approximated by the Fourier series expansion of curvilinear coordinate along the cross section. Finite element formulation is carried out based on principle of virtual work. Analysis of this element can save the computation time and maintain appropriate numerical accuracy by means of introduction of Fourier series.

CONCURRENT ENGINEERING ... ANYONE?

O. Unas, PHILIPPINES

Manufacturing is critical to the Philippines' survival. However, nowadays success in the manufacturing sector requires the ability to consistently produce products of superior quality, at competitive prices, and with minimum order lead times.

The concept of concurrency is fundamental to reducing new product development cycles and to the strategically planned introduction of product upgrades and enhancements. The implied underlying objective is to reduce the cycle time to its lowest possible level by designing the product along with its associated production and inspection processes at the same time.

Concurrent engineering is based on all functions working together - Design Engineering,

Marketing, Drafting / Detailing, Manufacturing Engineering, Mechanical Engineering, Industrial Engineering, Tooling, Process Engineering, Materials, Purchasing, Finance, Package Design, Distribution, Field Service, Key Suppliers, Customers and Management. The approach is that of a true cross-functional team, responsible and accurate in results - performance, reliability, cost, configuration, delivery and field support.

Results ..number of drawings reduced from 200 to 3, engineering change time reduced by 80%, engineering drawing access time reduced from several days to a few minutes, complete elimination of physical mockup, a 700% process yield improvement, a 30% savings in inventory costs, an 80% reduction in rework.

Thus, concurrent engineering can effectively create an environment that promotes continuous improvement in both customer satisfaction and bottom-line profitability.

DYNAMICS AND ROBOTICS

AN INVESTIGATION INTO THE STICK-SLIP EFFECT OF PNEUMATIC ACTUATORS

G.H. Lim, P. Chua, SINGAPORE

Pneumatic actuators are widely used in industrial automation activities and a full knowledge of its dynamic performance characteristics under changing operating conditions is particularly useful in modeling pneumatic servo-positioning systems or in establishing preventive maintenance procedures for pneumatic control systems.

This paper describes an experimental study to evaluate the operating conditions in which stick-slip phenomenon may occur in pneumatic actuators. Generally, the occurrence of stick-slip during operation is undesirable because the motion of the pneumatic actuator becomes jerky. Experiments were carried out to study the influence of piston seal materials, piston seal design, cylinder operating pressure and velocity, and the presence or absence of lubrication upon pneumatic actuator performance. It is found that the velocity of the pneumatic piston has a predominant effect in actuator motion. This is particularly pronounced when the actuator velocity is at 0.1 m/s or below. In addition, minimizing the friction force between the piston seal and cylinder barrel such as the use of lubricant has a positive effect. However, a large amount of lubricant does not appear to improve actuator performance further. Furthermore, it is found that the use of Viton seal appears to produce higher friction forces among the three seal materials tested.

APPROXIMATING CARTESIAN STRAIGHT LINE PATH IN SCARA ROBOT JOINT SPACE USING CLOTHOID CURVES

F. Salcedo, PHILIPPINES, H. Makino, JAPAN

The path or locus of motion of the end--effector of an industrial robot is naturally planned and represented in Cartesian space. To effect the actual motion of the robot from one Cartesian position to another requires, however, coordinated movements of the actuators attached to the robot links which are in turn naturally defined in the robot's joint space. The joint space coordinate corresponding to a given Cartesian position are computed by inverse kinematics. The conversion and complexity of the inverse kinematic computation will depend specifically on the robot's physical configuration.

In this research, we present a new method for approximating a Cartesian straight line path in SCARA robot joint space sing piecewise clothoid curves.

Empirical tests, using the dimensions of an actual SCARA robot, were performed to analyze the performance of the proposed approximation method. Five horizontal lines and five vertical lines from the SCARA robot's standard working area have been tested as the ideal lines. The number of sampling points for each line was varied, specifically, each line was divided into an equal length segments, where n = 2, 4, 5, 8, 10, 20. The errors were computed as the difference between the actual and approximated x coordinates (for vertical lines), and the actual and approximated y coordinates (for horizontal lines). As a representative example, each horizontal line was subdivided into 10 equal length segments yielding 11 sampling points. The absolute maximum error obtained for H1, H2, H3, H4 and H5 are 0.00053mm, 0.00045mm, 0.00048mm, 0.00071mm and 0.00356mm respectively. These errors can be considered as small and acceptable for most practical purposes.

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Satisfactory approximations were obtained from the preliminary numerical tests performed. Further experiments, however, still need to be performed on an actual SCARA robot.

AN INITIAL DESIGN OF A PICK AND PLACE PNEUMATICALLY CONTROLLED ROBOT ARM WITH MULTI - MOVEMENT MECHANISM

F.R. Argamosa, M. Dakanay, PHILIPPINES

Pick and place robot arm is the simplest type of industrial automation used in manufacturing operation. Robot arm may either be pneumatically, hydraulically or electrically controlled. They are described as simple because of the nature of their movement.

The most economical among the three controls is the pneumatically controlled pick and place robot arm. However, to increase the possible movement of the robot arm (degrees of freedom) there must be a corresponding increase of actuators (Pneumatic cylinders). Increasing actuators tends to increase the weight of the arm, at the same time adds cost to the unit due to additional components that may be needed.

This paper presents a mechanism designed to increase the available movement of a pick and place robot arm without adding additional actuators (pneumatic cylinders). Performance test results show that the prototype was able to increase its movement and was able to perform its task without the addition of any actuators.

FINITE ELEMENT ANALYSIS OF A PQFP PRINTED CIRCUIT BOARD ASSEMBLY

P.K. Fok, F. F. Yap, Q.J. Yang, G.H. Lim, SINGAPORE

Surface Mount Technology (SMT) is fast becoming the assembly technology of mounting solid state devices to printed circuit board (PCB), replacing the pin-in-hole (PIH) technology. Dynamic effects arising in an electronic package, whether owing to environmental, manufacturing, shipping, or other causes, may result in large vibration amplitudes being sustained by the package. These vibrations are transmitted throughout the PCB, inducing stress in the connectors, modules, and perhaps most importantly, the leads and solder joints attaching the modules to the PCB. Over stressing any component of a populated PCB can lead to performance degradation and possibly to the complete failure of the system. Thus, an understanding of the mechanics of these phenomena is most important and appropriate.

The objective of the paper is to model and analyze the PQFP-PCB assembly using finite element analysis. For the finite element modeling, a two-level sub-modeling technique was employed in the model of the board, leads and ceramic modules. The first level of this sub-modeling method is to model the lead and solder joint so as to obtain the effective stiffness of the element that has effective stiffness coefficient obtained in the first level sub-modeling. In order to verify the finite element results, an experimental modal analysis of the PCB assembly is conducted.

From the results presented in this paper, we can arrive at the following two conclusions. Firstly, the sub-modeling approach was found to be an effective method of simplifying a complex finite element model. Secondly, a relatively good correlation between the finite element model and the modal analysis result was established by comparing the mode shapes and natural frequencies.

INTELLIGENT SYSTEM TECHNOLOGIES FOR CONTROL OF A WALKING ROBOT

R. Alienza, M. Ang Jr., SINGAPORE

Legged robots are continuously gaining popularity because of their ability to travel on uneven terrain making them suitable for many types of environments. To develop the ability to walk on a variety of surfaces, a legged vehicle must have a robust controller.. The overall control of walking robots range from high-level tasks such as navigation and planning to low level capabilities such as motion coordination of the legs and servo-control of each joint. Two popular paradigms for intelligent control have been proposed far; the behavior-based and the knowledge-based controllers. The knowledge-based approach emphasizes on building modules for sensing the environment, molding it, planning based on this perceived model and executing the planned action to achieve a certain task. The behavior-based approach is more superior in terms or response time, modularity, and robustness. A behavior-based controller is made of several layers of modules that operate at increasing level of competence. Each level of competence is composed of several task-achieving

behaviors or modules interacting with each other and the environment to achieve a certain goal. When confronted by a dynamic environment, a behavior-based robot can react fast because of the direct coupling between its behaviors and the sense states. It can also handle unpredictable situations to a large extent because its behaviors try to achieve a common goal without restricting themselves within a predefined set of rules. The robot controller can be built incrementally, thus making it highly modular and easy to construct.

In the Department of Mechanical Engineering at the National University of Singapore, we have developed a general framework for behavior-based control. The controller has been implemented in a real time on a four legged robot (MARC-1) Task-achieving behaviors are built one by one and incrementally added in a simple priority-based and subsumption architecture. This architecture allows output of certain modules to "subsume" those of other modules. From the interaction between these modules our quadruped is able to walk on uneven terrain.

For MARC-1 to walk, the following levels of competence are required: Rest, Standup Pose, Walking on Uneven Terrain, and Detecting and Manuevering around Obstacles. To be able to move the legs and body, module Servo Control is developed. It is a low-level fuzzy logic control system that drives all joints in a synchronized manner to achieve their desired positions. The second behavior developed name GoHome enables the robot to achieve home or rest position during start up by locating the origin of each joint. Standup module is built next so that the quadruped can assume standing up posture from its rest position.

Once the quadruped can already stand up, the next set of behaviors has something to do with walking on even terrain. This includes UpLegx, Advance Legx, DownLegx, Walk and Balance. To collect data from sensors, Fsensor, IRSensor and RPSensor are added. By analyzing, these data, the quadruped is able to detect, step over and avoid obstacles while maintaining its body plane normal to the gravitational vector using CollideLegx, FootxForce, RPxBalance and Adjust RPH. Each of these modules can be described in terms of its function(s) or behavior(s) depending on the sensor inputs.

Interaction between behaviors is through a common communication line. The goal of every module is to grab the communication line and pass its output message to the other modules. Arbitration on which module can use the communication line is determined through priority and first-come-first-served basis. We use an encircled 's' to implement the priority basis. It means that the output line of the module without an arrow entering 's' can be suppressed/enabled by the upper module can also suspend / wake up the operation of the lower module. On the other hand, an encircled 'e' means that all modules connected to it have equal priorities. When a module is writing on the output line, the rest waits for its completion (first-come-first-served basis).

One test demonstrated MARC-1 quadruped walking forward on a 2-m path with a 5cm high, 1m wide and 1.5m long obstacle. The flexibility of the control architecture has also been demonstrated when a simple navigation capability was added. Here, MARC-1 traced the sides of a 2m by 1.8m enclosed rectangular area with a 5cm high, 30cm long obstacle inside.

A STUDY OF VIBRATION INTENSITY MEASUREMENTS IN PLATES

M. Nakajima, M. Okano, JAPAN

Vibration intensity is defined as vibrating energy flow. It is expected to be useful to know excited points and transmission paths. In recent years, measurement methods of vibration intensity is under study.

We took notice of transverse vibration and made a experiment to measure vibration intensity in plates. The purpose of this study is to find effectiveness of one dimensional wave's theory at plate.

ON EXPRESSION OF HUMAN BODY MOTION

T. Sakata, T. Nishimura, Y. Wada, M. Itoh, S. Yanagi JAPAN

It is important to express exactly a human body motion on a study of a human motion. If we can neglect a small deformation or distortion at a human joint, a human body is replaced by the mechanical link system. Since a human joint is a spherical or pinned type, a human body motion is performed by the superposition of a relative rotational motion at each joint. We discuss the method of resolving a relative rotational motion on a

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R. Atienza, M. Ang Jr., SINGAPORE

Legged robots are continuously gaining popularity because of their ability to travel on uneven terrain making them suitable for many types of environments. To develop the ability to walk on a variety of surfaces, a legged vehicle must have a robust controller.. The overall control of walking robots range from high-level tasks such as navigation and planning to low level capabilities such as motion coordination of the legs and servo-control of each joint. Two popular paradigms for intelligent control have been proposed far; the behavior-based and the knowledge-based controllers. The knowledge-based approach emphasizes on building modules for sensing the environment, molding it, planning based on this perceived model and executing the planned action to achieve a certain task. The behavior-based approach is more superior in terms or response time, modularity, and robustness. A behavior-based controller is made of several layers of modules that operate at increasing level of competence. Each level of competence is composed of several task-achieving

behaviors or modules interacting with each other and the environment to achieve a certain goal. When contronted by a dynamic environment, a behavior-based robot can react fast because of the direct coupling between its behaviors and the sense states. It can also handle unpredictable situations to a large extent because its behaviors try to achieve a common goal without restricting themselves within a predefined set of rules. The robot controller can be built incrementally, thus making it highly modular and easy to construct.

In the Department of Mechanical Engineering at the National University of Singapore, we have developed a general framework for behavior-based control. The controller has been implemented in a real time on a four legged robot (MARC-1) Task-achieving behaviors are built one by one and incrementally added in a simple priority-based and subsumption architecture. This architecture allows output of certain modules to "subsume" those of other modules. From the interaction between these modules our quadruped is able to walk on uneven terrain.

For MARC-1 to walk, the following levels of competence are required: Rest, Standup Pose, Walking on Uneven Terrain, and Detecting and Manuevering around Obstacles. To be able to move the legs and body, module Servo Control is developed. It is a low-level fuzzy logic control system that drives all joints in a synchronized manner to achieve their desired positions. The second behavior developed name GoHome enables the robot to achieve home or rest position during start up by locating the origin of each joint. Standup module is built next so that the quadruped can assume standing up posture from its rest position.

Once the quadruped can already stand up, the next set of behaviors has something to do with walking on even terrain. This includes UpLegx, Advance Legx, DownLegx, Walk and Balance. To collect data from sensors, Fsensor, IRSensor and RPSensor are added. By analyzing, these data, the quadruped is able to detect, step over and avoid obstacles while maintaining its body plane normal to the gravitational vector using CollideLegx, FootxForce, RPxBalance and Adjust RPH. Each of these modules can be described in terms of its function(s) or behavior(s) depending on the sensor inputs.

Interaction between behaviors is through a common communication line. The goal of every module is to grab the communication line and pass its output message to the other modules. Arbitration on which module can use the communication line is determined through priority and first-come-first-served basis. We use an encircled 's' to implement the priority basis. It means that the output line of the module without an arrow entering 's' can be suppressed/enabled by the upper module can also suspend / wake up the operation of the lower module. On the other hand, an encircled 'e' means that all modules connected to it have equal priorities. When a module is writing on the output line, the rest waits for its completion (first-come-first-served basis).

One test demonstrated MARC-1 quadruped walking forward on a 2-m path with a 5cm high, 1m wide and 1.5m long obstacle. The flexibility of the control architecture has also been demonstrated when a simple navigation capability was added. Here, MARC-1 traced the sides of a 2m by 1.8m enclosed rectangular area with a 5cm high, 30cm long obstacle inside.

A STUDY OF VIBRATION INTENSITY MEASUREMENTS IN PLATES

M. Nakajima, M. Okano, JAPAN

Vibration intensity is defined as vibrating energy flow. It is expected to be useful to know excited points and transmission paths. In recent years, measurement methods of vibration intensity is under study.

We took notice of transverse vibration and made a experiment to measure vibration intensity in plates. The purpose of this study is to find effectiveness of one dimensional wave's theory at plate.

ON EXPRESSION OF HUMAN BODY MOTION

T. Sakata, T. Nishimura, Y. Wada, M. Itoh, S. Yanagi JAPAN

It is important to express exactly a human body motion on a study of a human motion. If we can neglect a small deformation or distortion at a human joint, a human body is replaced by the mechanical link system. Since a human joint is a spherical or pinned type, a human body motion is performed by the superposition of a relative rotational motion at each joint. We discuss the method of resolving a relative rotational motion on a

human body motion and apply the method to an actual swinging motion of arm in this study.

THE CONTROL ANALYSIS OF UNICYCLE ROBOT

M. Tamura, O. Michiharu JAPAN

This report describes of "the control analysis of unicycle" by using unicycle robot model that we suggested. The ultimate goal of this study is to explain how human can ride a unicycle well. So in this study, we took notice of two motions. They are pedaling and steering. Then, we made a unicycle robot as doing the motions. The robot quickly steers a tire and swinging back and forth to keep its balance. So we designed the control system for the unicycle robot by using optimal control theory. We researched whether the method is valid for controlling the unicycle robot.

DYNAMIC ANALYSIS OF CABLE- MEMBRANE STRUCTURES WITH SLACKENING MEMBERS

Y. Miyazaki, Y. Nakamura - JAPAN

The critical problems in simulating geometrically nonlinear motion of cables and membranes by finite element method are reviewed with numerical examples, i.e. the problem of slackening and time-integral scheme. A nonlinear finite element formulation of dynamics of cables and membranes is presented which can describe the slackening of cables and membranes. The proposed finite element method satisfy the condition that the change of the total energy is kept equal to the external work acting on the structure through the numerical simulation. So the numerical instability of the time integral scheme dose not appear unless the motion is really instable.

A REVOLUTE ARM MOUNTED ON AN X-Y COORDINATE PLANE

E. Guison, Jr., PHILIPPINES

Most manipulators presently have limited degrees of freedom thereby decreasing its work space or work envelope. The aim of this study is to develop a low cost manipulator that integrates and combines the revolute and the Cartesian coordinate manipulator's structure and degrees of freedom to create a manipulator with the capability of working in a large work space. The result is a fully functional revolute robot mounted on an X-Y coordinate plane. The revolute arm is modeled as that of a human arm that is composed of the shoulder, the elbow and the wrist. The wrist or end effector has three movements, the pitch, the roll and the grip. The whole assembly of the arm can be rotated through its base and can be translated in the X-Y direction within a given coordinate plane. It can place and pick an object, with a maximum weight of 150 g, from one point to another. It can be operated or programmed manually to derive a given set of movements using the manipulator's software. The software also has an option to run the programmed movements continuously or up to ascertain number of repetitions. Accuracy and repeatability of the system is dependent mainly on the mechanical system. Based on the results, 100% accuracy was achieved on the X, Y, Base, Forearm, and Pitch movement due to a satisfactory mechanical design with 2mm tolerance. However the roll movement only achieved a 65% accuracy at 2mm tolerance due to backlash and errors in the fabrication of the roll mechanical parts. Due to the increase in degrees of freedom , the manipulator had a large working envelope and working space as compared to the single revolute arm, and Cartesian coordinate arm manipulator.

VISION ASSISTED SCARA (SELECTIVE COMPLIANCE ASSEMBLY)

P. Lim, S. Lim, E. Luna, J. Sotto, C. Syling, PHILIPPINES

This paper presents the design, development and testing of a Selective Compliance Assembly Robot Arm (SCARA) which can differentiate and sort seven basic shapes using a vision system. The vision system consists of two parts: an image capture and processing system and a neural network based identification system.

The robot arm was designed and demonstrated 100% point to point accuracy with a tolerance of 1mm. The control hardware and software were designed and tested being linked to the vision system.

The vision system consists of video capture hardware and image processing software which captures the image of the test shapes and segments, and processes and feeds them to the neural network. The neural network matches the test shape with one of the seven pre-trained test shapes and feeds this information to the robot arm control system.

The neural network was trained using a back propagation algorithm utilizing a training set of 140 samples. The samples were taken from captured images of the seven basic shapes using the image capture and processing system. The neural network has been trained such that it can identify all seven basic shapes regardless of orientation.

Test results show that the system achieved 100% recognition of the seven test shapes in 100 test runs. The system also proved stable, running for an aggregate of eight uninterrupted one-hour cycles without experiencing any malfunction.

NEURAL NETWORK APPLICATION TO PATTERN RECOGNITION

E. Dadios, PHILIPPINES

Artificial neural networks have been widely researched and numerous applications have been proposed. Since the potential of vision system to control problems and robotics was recognized, the topic of pattern recognition has received much interest. Pattern recognition has many important applications in such areas as optical coding, character reading, factory robotics, and analysis of areal photographs. This paper investigates the capability of artificial neural network to identify and recognize different sets of patterns. The English alphabets have been used as patterns to be identified, making the problem complex because the neural networks need to identify 26 varying characters. The alphabets are linearized into grid pixels in binary format and stored into pixel-matrices. The learning process uses a teacher that maps a character pixel-matrix pattern into an SCII format.

In this work, the standard learning protocol assumes that by making an educated guess one chooses a network and trains it to make the correct responses for a restricted number of teaching examples in terms of a learned task. It is expected that the trained netwrok will generalize information from the training set and use it to correctly identify new examples of the same task. The objective of this research is to use a feedforward neural network to recognize complex patterns of literal characters by mapping pixel-matrix patterns corresponding to ASCII codes. The characters identified by the neural networks are displayed on the computer monitor. Results of the experiments shows that the neural network able to recognize the patterns even on noisy environments.

IMPACT CLOSURE OF PLANAR OPEN CHAINS

S. Hazarika, S. Mukherjee, JAPAN

On going from "no-grasp" to "grasp", fingers cannot be positioned with perfect control of force and location for every element in contact with the object. During this transition impact generally occurs. We investigate this impact situation for a 2-finger 4-dof planar hand, and present equations to analyse it. Simulation results of the whole system is presented.

STUDY ON OPTIMUM RESULTANT FORCES IN INDIVIDUAL TIRES OF THE VEHICLE AT BRAKING IN TURN (STABILITY ANALYSES IN BRAKING SITUATIONS OF ARTICULATED ROAD TRAINS

T. Sekine, H. Nagae, JAPAN

The stability and the controllability of road trains are important to secure the traffic safety. In this paper, the main object is to make clear systematically for the articulated road train's peculiar problems a 'Jackknifing'. By employing the quasi-static problem into the rigid vehicle theory for the simplification of the calculations, the statistical stability on articulated road train are carried out by calculations for the new index as static margin of tractor. The results revealed that articulated road train is able to achieve the critical deceleration ratio without wheels lockup when the maximum authorized payload put on center of loading platform, and it is suited in fact.

SOME ENERGY AND POWER ANOMALIES IN SIGNAL ANALYSIS

A.V. Estalilla, PHILIPPINES

A passive LC network (the electrical analog of a non-dissipative spring-mass system) is shown to produce the following anomalies: (a) an input signal of finite energy content gives an output signal of infinite energy content, and (b) an input signal of zero average power causes an output signal of nonzero average power, apparently violating the law of energy conservation.

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SOME APPLICATIONS OF TERRADYNAMIC METHODS

I.V. Simonov, Y. Bivin, O. Khavroshkin , RUSSIA

In addition to the known ideas oriented on astrophysical researches and many other piece technology, the kinetic systems are suggested for:

(1) control influence over active volcano with aim of the prevention of catastrophic events by penetration of weak spots on the volcano walls;

(2) rapid and economic formation of deep prospect-holes and wells;

(3) impact-penetration experiments with Near-Earth Meteoroids; and

(4) large impact onto danger asteroid by massive impacter produced from cosmic debris.

These based on analyses of refraction-penetration phenomena and rectilinear or in-plain motion of rigid shapes of revolution or group of projectiles in natural media at sub-and-supersonic velocity by various methods.

In the theoretical field the asymptotic approaches to elastoplastic flow around sharpened and blunted bodies without and with influence of cavitation are developed. The efforts were expanded to prove the empirical polynomial representation for forces and to provide the optimal and stable deep penetration. The curve trajectory is often watched in axially symmetric experiments. Consequently, the stability of rectangular high-velocity penetration is in question. Using a mathematical model of the rigid body in-plain motion with influence of asymmetric cavitation, the criteria of the stability are deduced by Liapunov's method both for the full wetting and for appearance of the small free zones on the lateral surface of an elongated body. Estimate of maximum pressure, temperature and drag force are deduced for a blunted shape at the supersonic motions in condensed medium.

The pioneering empirical laws of refraction ricochet, penetration and crater formation are discovered at the normal and oblique enter of different compact shapes or groups of rigid or deformable bodies in some terrestrial media. The refraction laws passes both the similarity and difference from the optical ones. So, the intermediate case of a partial ricochet is revealed in case of group of projectiles arranged in single file. Wide possibilities of crater architecture control are proved in these tests.

LASER SPECKLE INTERFEROMETRY A PRECISION MEASURING TOOL FOR INDUSTRY

H. L. Yadav, B. Chaudhuri, INDIA

The conventional design analysis of engineering components assumes a defect free structural geometry and determines the relationship between the applied load and maximum stress that develops in components. Safe design is achieved by making sure that the maximum stress is less than ultimate stress of the materials. Experiments performed on glass fibers led to the conclusion that the strength of real materials is much smaller than their theoretical strength. In an effort to explain these phenomena, a new design philosophy known as fracture mechanics was introduced which is based on the realistic assumption that all materials contain crack-like defect / flaw which constitutes the nuclei of fracture initiation. In such engineering materials, the crack tip is highly stressed region from where crack initiation takes place. Therefore, the study of the displacement and stress field around the crack tip becomes very important for determining fracture parameters.

To study the strain/stress field around the crack tip, a number of experimental methods are used, including both point by point methods and whole field methods. Electrical strain gauge, dial gauge, extensometers, etc. are the most common instruments used for analyzing crack tip strain fields by point method. These instruments have disadvantage of being contact type. For the whole field analysis of the strain/stress around the crack tip, photoelasticity, and metro interferometric techniques have been used over past many years. From last few years speckle interferometry and speckle photography are being investigated for the study of displacement held around the crack sip. By using speckle photographic technique we can straight away measure the crack opening displacement (COD) and crack tip opening displacement (CTOD).

APPLICATION OF FUZZY LOGIC TO CONTROL A PRESSURELESS BOTTLE COMBINER

E. Calilung, PHILIPPINES

The present bottle-handling machines utilized by the beverage bottling industry are automated using PLC's or programmable logic controller both at the individual machine level and at the system level. While ladder-logic based automation programs for PLC's offer vast improvement in terms of flexibility and ease of control implementation over the traditional hard wired control logic, recently developed intelligent controllers such as fuzzy logic demonstrate significant improvements in speed and accuracy as well as intelligent capabilities such as learning and performance optimization.

In this study, a pressureless combiner for glass bottles was designed and fabricated for automatic control using PLC. A fuzzy logic control program was developed in Visual Basic and interfaced with the pressureless combiner PLC using FIX SCADA software from Intellution. The pressureless combiner and fuzzy logic control was tested by running in a full-scale conveyor test loop. Preliminary performance results showed that the performance of the fuzzy logic controlled combiner was at par with ladder logic implemented control, particularly at stable input and output bottle flow rate. Tests will also be conducted under varying upstream and downstream bottle flow conditions wherein the fuzzy logic controller is expected to perform better.

MEASUREMENT AND CONTROL OF BRIDGES DURING CONSTRUCTION AND LONGTERM

T. Javor, E. Javor, SLOVAKIA

Various applications of the stress-strain control during construction and long-term service life of prestressed concrete bridges have been made. The safety of these structures is analyzed using embedded vibro-wire gauges, thermometers, repeated NDT concrete quality control, and creep-shrinkage samples. Experimental stress analysis of concrete bridges is made indirectly by evaluation of material constraints and calculating stresses from measured strains. The influences of temperature and humidity on creep, shrinkage and modulus of elasticity are examined. A portable measuring system consisting a microcomputer and portable measuring equipment (printer and plotter) was developed and used.

The paper will show the results of the observation of various cantilever and cable-stayed bridges, like the largest concrete bridge in Slovakia crossing the river Danube in Bratislava during construction by help of over 360 embedded acoustical vibro-wire gauges and other equipment. The strain history of a cast in place cantilever prestressed concrete bridge as well as the history of hydration heat during concreting show the very important results for the designer and research engineers. The course of strains and deflections during 40 years of traffic gives us the possibility by mathematical correlation new formulas to predict the service life of the concrete bridges, and their bridge capacity rating.

MATHIEU's STABILITY CHART BY NUMERICAL INTEGRATION

C. Nakhaie-Jazar, B. Shiari, N. Amanifard, IRAN

We have developed an algorithm based on integral of energy and numerical integration to predict the stability regions of Mathieu's equation $\ddot{x}+a.x-2b.x.\cos(2t)=0$ for large b in a-b plane. Especially, it have shown that one could find any point on the boundary of stability more accurate than any other methods, but not faster. Graphics of these stability regions are presented based on extensive computation.

A standard procedure for investigating the stability of a periodic motion in an autonomous nonlinear system involves linearizing in the neighborhood of the periodic motion, resulting in a linear differential equation with periodic coefficients, i.e. Floquet theory. The most comprehensive treated of classical methods for analysis of the Mathieu equation has been given by McLachlan. It is known that the Mathieu's equation could have periodic solution depending on parameters a and b and independent on initial conditions, due to the linearity of the equation.

The relationship between a and b for periodic solution generates a graph which names the stability chart. The relation could be developed analytically by Fourier coefficients and/or Poincare-Lindstad perturbation methord, but both of these methods cannot predict the stability chart for large b.

APPLICATION OF ARTIFICIAL INTELLIGENCE TO ELECTRICAL POWER SYSTEM FAULTS

F. Dadios, PHILIPPINES

One of the most interesting applications of Artifical Intelligence (AI) is the development of a system that tries to mimic the expertise of a human expert (Expert System). In developing this type of system it is important to know exactly what a human expert is and how human expert uses his expertise (involves gathering, representing, and manipulating information). This research is focused on developing an AI software to simulate electrical power system faults. The environment in which the electrical power system operates is very complex. New constraints are appearing, old constraints are tightening, and the number of decision variables is increasing. Human operators in this environment often suffer from information overload particularly during times of crisis. It is therefore the direction of this research to develop an intelligent assistant (a computer assistant to simulate the electrical power system faults). In particular, this assistant will 1) provide means for the operators to communicate with computers in natural and easy way; 2) reduce the information load of the operators by summarizing the results (i.e., calculating the values of fault currents and voltages); 3) recognize the circumstances that require operators attention; 4) evaluate past system operations to see if previous information are useful to existing circumstances; 5) search operators manual and display the portion relevant to existing circumstances; 6) deduce what happened and why and when sudden transition in power system occurs; and 7) provide advice and help formulate plans and activities such as system restoration and inter-utility power exchanges.

In this research, the electrical power system fault simulation includes diagnostic and calculation. Here, the AI software is capable of determining the type of fault that occurred, the location of this fault, and the reason of this fault. The calculation of the fault currents and voltages is necessary to evaluate the condition of the entire power system (i.e., to identify the affected equipment due to this fault). From these numerical values the AI software can pinpoint the effects of the fault to the power system (i.e., to determine the damage equipment). One of the important capabilities of this research is it can simulate an electrical power system to undergo into different types of faults in order to get prior knowledge of the protective device necessary to protect the elements of the electrical power system. Results of include graphical representation of the interconnection of all the elements of the power system, the location and the connection of the element having fault, and all the damage equipment due to this fault.

PART MATING METHODS AND EQUIPMENT WITH THE KALMAN FILTER IN FOCUS

I. Katupitiya, AUSTRALIA; A. Chua, PHILIPPINES

This paper presents the different equipment and methods used in part assembly with their advantages and disadvantages. At the same time a new technique applied to a peg-hole assembly process will be introduced. First, the passive and active compliance equipment and methods presently being used will be described. Secondly, the paper will discuss the different force sensing strategies as applied to the part mating process. Thirdly, the paper will focus on the Kalman filtering with a force moment sensor strategy as a possible technique to solve the uncertainty problem in part mating. Finally, simulation and experimental results will be presented to show the power of the Kalman filtering technique in solving the peg-hole insertion problem.

A STUDY OF A SURFACE INSPECTION SYSTEM IN A HOT ROLLING LINE FOR STEEL PRODUCTS

I. Sugimoto, JAPAN

The steel industry is constantly trying to reduce production cost and improve quality by making the steel manufacturing processes continuous and faster. Currently, the rolling process is not yet appreciably automated. The finishing processes involve many tasks difficult to automate, such as defect inspection and repairing the detected defects. In recent years, however, many automated and labor-saving systems have been developed for use in the finishing processes. The surface defect inspection of steel products is the largest bottleneck in the finishing process. This paper describes an inspection system of steel surface defects for large sections, such as wide flange beams and I - beams. This system is based on applied radiant light and it senses the temperature deviation caused by defects. The wavelength of the detector is optimized to improve the signal-to-noise ratio. An optical attenuator was developed to compensate for the known temperature distribution across the product immediately after rolling. This paper describes basic

experimental results for detecting the defect for a hot rolling line on steel products.

MEASUREMENT OF STATIC AND DYNAMIC SUBMICRON DEFORMATION BY HOLOGRAPHIC INTERFEROMETRY

H. Hatagochi, Y. Shimbori, JAPAN

Holographic interferometry can measure static and dynamic deformation of complicated objects which have a rough surface, and the accuracy of measurement is around 1/2 a wavelength of the light source. It is widely applied to various engineering fields. Usually, we make a hologram by a reference beam and an object beam exposed on a dry plate. Interference fringes are generated by optical path differences between the original object and its deformed object. The deformation quantity that is equal to one fringe is around 0.3 μ m (Light source : He-Ne laser, λ =0.6328 μ m), and a fringe in the deformation quantity of less than o.3 μ m is not generated. Generally, when many fringes on an object are generated, we can estimate the measured values of a chosen position by interpolation or extrapolation of the finges. However, when the deformation of the object is less than 0.3 μ m, we can not estimate it because there are no fringes.

Therefore, we made carrier fringes that are generated by an optical path difference between two illumination beams and superimposed deformation fringes on the carrier fringes. We tried to measure the static submicron deformation (less than 0.3 μ m) of the object from the movement of the carrier fringes by a multiple exposure method. Also, we tried to measure the amplitude of the submicron vibration by using a stroboscopic method such as a vibration analysis of comparatively low frequency (less than 1kHz).

Accordingly, this report is on the two illumination beam method which was successful for the measurement of static and dynamic submicron deformation with ordinary experimental equipment.

NON-CONTACT DYNAMIC MEASUREMENT DEVICE OF CROSS SECTIONAL SHAPE BY LIGHT-SECTIONING METHOD

H. Yoshida, N. Kawahata, JAPAN

This report describes a newly developed remote sensor system to measure cross sectional shape with high resolution by light-sectioning method. It is based on triangulation principle, where infrared laser sheet is emitted from a laser diode, and the reflected light from the cross section is taken by a CCD camera, and processed by a computer. Time consuming image processing is conducted by analog circuit, so that the sensor system is capable of real time measurement for oscillating object with 50Hz. High resolution of 1 mm at 2 m distance has been achieved by an afocal lens system attached to a usual CCD camera.

DEVELOPMENT OF SERVO-TYPE VELOCITY AND DISPLACEMERT SENSOR FOR THE VIBRATION CONTROL OF FLEXIBLE STRUCTURES

Y. Satoh, H. Saitoh, Y. Itoh, Y. Gatade, K. Seto, JAPAN

This paper presents the development and implementation of a new servo-type vibration sensor which can measure both absolute velocity and displacement signals simultaneously under the low range of frequency. In general, the measuring range of seismo-type sensor is higher than its natural frequency. For the purpose of increasing the measuring frequency range of the sensor, it is necessary to decrease the natural frequency of the sensor. In this paper, the sensor with low natural frequency is realized by a positive feedback method. As a result, a sensor with light mass and hard spring is obtained . This sensor is shown to be effective in controlling the vibration of a flexible structure.

FLUIDS MECHANICS

A COMPARATIVE STUDY OF THE ENTRAINMENT FLOW PARAMETERS WITHIN THE TEST SECTION OF SUBSONIC OPEN TYPE AND CLOSED TYPE WIND TUNNEL

A. Mazumdar, INDIA

The development of turbulent boundary layer primarily depends upon the rate of entrainment of outer fluid into the boundary layer. When air flows through the square test section of a subsonic wind tunnel, boundary layer grows on its four flat surfaces. Jadavpur University open circuit subsonic wind tunnel, installed in 1961, has been recently modified to the closed type in such a manner that a new bigger test section is included while the original square test section (750mmx750mm) with its contraction code remains unaltered. The growth of boundary layer on the four surfaces of the original

test section would be similar and its characteristics may be compared with those of two dimensional incompressible boundary layer over a flat plate at zero incidence with incoming flow, if the end effects are neglected. The development of boundary layer is related to the entraining fluid from the irrotational fluid flow outside it. In order to analyse the change in the growth of boundary layer within the same original test section as the wind funnel has been converted from open type to the closed type one, it is important to study the variation of entrainment flow parameter within the test section.

The experimental determination of the growth of boundary layer within the test section of the wind funnel was carried out by obtaining the velocity profiles at different stations chosen suitably along its length with the help of a suitably designed pitot tube, a static tube and an inclined tube manometer. Boundary layer parameters and entrainment parameter may be computed following their definitions with the help of a computer program based on cubic spline fitting of interpolated data and integration through Simpson's trapezoidal rule.

Two dimensional turbulent boundary layer may be solved by integral method based on Karman momentum integral equation and two other auxiliary equations. While classic correlation suggested by Ludweig Tillman may be considered as the second relation, the third one may be the differential equation, suggested by Head, relating the rate of change of entrainment parameter with distance from the leading edge.

In the present article an attempt is made to study the variation of the entrainment flow parameter in the growth of boundary layer within the same test section of Jadavpur University subsonic wind tunnel as it was changed from open type to the closed type one. An attempt is also made to determine the entrainment function correlation for both open and closed circuit types based on experimental investigation.

PERFORMANCE ENHANCEMENT OF A HEAT EXCHANGER USING SECONDARY FLOW EFFECTS

TT Chandratilleke, AUSTRALIA

Heat exchangers in many engineering applications, such as waste heat recovery, require a compact design due mostly to space constraints of the existing layout. A size reduction is generally achieved by augmenting the heat transfer process between fluids with certain well established techniques which introduce turbulence artificially into flow streams. Recent studies indicate that heat transfer rates are significantly improved in fluid flow arrangement where secondary flow exists. In this paper, the heat transfer performance is examined of a heat exchanger which harnesses the effects of secondary flow in fluid streams.

A heat exchanger with curved flow passages of constant curvature is designed, built and tested for its performance. The aspect ratio of the flow cross section and the channel curvature are selected to obtain the secondary flow instability in the hot and cold streams of the heat exchanger over a wide range of flow rates. Visualization tests are conducted to confirm the secondary flow behaviour in the channels. The performance of the heat exchanger is tested using hot and cold water streams with adjustable flow rates and temperatures. The temperature of the fluids across the channel width is measured at selected cross sections along the length of the heat exchanger together with the inlet and outlet temperatures of the streams. The heat transfer between the two streams is evaluated and the heat exchanger effectiveness is estimated.

The fluid flow through the heat exchanger is numerically simulated to predict the onset of secondary flow instability and the heat transfer rates.

The results clearly indicate that there is significant improvement in the heat transfer characteristics of the heat exchanger with streamwise curvature. The appearance of additional secondary vortices (Dean vortices) is confirmed by both experimental observations and numerical analysis. The increased heat transfer rates are attributed to the presence of secondary flow in the streams. It is concluded that the mechanism of secondary flow and the associated heat transfer enhancement can be effectively utilized in heat exchanger design.

GASIFICATION OF HIGH MOISTURE ORGANIC WASTES: A MODELING AND DESIGN CONCEPTUALIZATION STUDY

F Vinluan, PHILIPPINES - H. Lim, KOREA

High-moisture organic wastes or biodegradables mixed with unrecyclable papers, cardboards and other combustibles create serious disposal problems. Uncollected wet garbage are

odorous, harbor flies and worms and cause the spread of diseases. When accumulated in dumpsites leachate is released which can contaminate the water table. An environmentally acceptable process that could convert these wastes into a usable form of energy is gasification.

In this study, a mathematical model based on thermodynamic equilibrium and heat and mass balances was formulated to aid in the analysis and to service as guide in the design process.

The result show that combustible low-calorie gas can be produced from high moisture wastes provided a supplemental fuel such as kerosene is added. In gasifying a given volume of waste common in Metro Manila (40 percent mcwb) the total energy generated is about four times the total energy value of the liquid fuel supplement. As the moisture content of the waste is reduced the energy gain is increased. To further reduce the need for fuel supplement low-moisture organic waste maybe added or a portion of the gas generated maybe recycled.

The design of a gasifier for high-moisture wastes is basically the same with the Philippine rice husk gasifier combustor but with added features. Among these are: a device to automatically add supplemental fuel depending on the moisture content, continuous feeding and ash removal mechanisms, airflow controller, etc. When fully developed this technology would have numerous applications as an energy producer and as a solid wastes consumer.

THREE DIMENSIONAL EFFECT ON THE WAKE OF A TWO DIMENSIONAL ROUGHNESS PLACED IN A LAMINAR FLAT PLATE BOUNDARY LAYER

M. A. Ardekani, H. Munakata, K. Ono, JAPAN

Flow field over a two dimensional roughness element (a square rod) placed in a laminar boundary layer developed on a flat plate was investigated by experiments and numerical computations in order to make clear the transition process. Hot-wire measurements were made in a low turbulence wind tunnel. The two and three dimensional unsteady Navier-Stokes equations were solved by the finite difference method. The transition process was found to depend on k/δ'_1, where k is the height of the roughness element, and δ'_1 is the displacement thickness of the laminar boundary layer at the element. Where k/δ'_1 is less than the critical value, the flow is two dimensional in separated region, and the 2D and 3D computational results agree with the experimental ones. When k/δ'_1 is larger than the critical value, the 2D computation is not enough because of the three dimensionality of the flow in the wake. The peak and valley structure, which was found in the process of the transition of the boundary layer without the roughness, was detected also in this case. But the structure was different from the flat place case. The inflectional instability play an essential role for the transition.

INTERACTION OF DISTURBANCES FORMED ARTIFICIALLY BY THIN JETS

T. Sugamata, A. Matsumoto, JAPAN

It was well known that the disturbance, introduced artificially into a supercritical two dimensional laminar boundary layer along a flat plate by ejecting a-intermittent jet from a small hole on the flat plate, developed downstream and finally evolved into a turbulent spot. As a jet was weak, however, this disturbance was still laminar during the initial stage of its downstream development and resembled a turbulent spot. Therefore, we call it a laminar spot. We attempted to promote a transition of boundary layer using the interaction of laminar spots without any distortion in a turbulent boundary layer. As the first stage of this study, we examined in terms of how such laminar spots interact with one another in such a way that we visualized the whole flow field including these disturbances by drawing several contours of the difference between an instantaneous streamwise velocity and Blasius velocity at the same position. It was found that three dimensional deformation became stronger because of laminar spots interaction. Thus, we could expect that the interaction of these spots favor a transition from laminar to turbulent boundary layer.

STATISTICAL ANALYSIS ON HIGH SHEAR-STRESS STREAKS OF TURBULENT BOUNDARY LAYER

M. Kimura, S. Tung, CM. Ho, JAPAN

Measurement of wall shear stress streaks of a turbulent boundary layer in the channel flow were carried out using MEMS-based micro shear stress imaging chip. The chip is designed and fabricated by surface micromachining technology which is compatible with IC technology. One array of 25

micro shear stress sensors in the chip that covers a distance of 7.5 mm is used to measure the instantaneous spanwise distribution of the surface shear stress. The characteristics of high shear stress streaks were described with statistics. Based on the measurement, the physical quantities associated with the high shear-stress streaks, such as their length, width and peak shear-stress level, were obtained. We found out that a high correlation exists between the peak shear-stress level and front-end shear-stress gradient of a high shear-stress streak.

DILUTE VERTICAL TRANSPORTATION USING SPIRAL FLOW

M. Takei, K. Horii, H. LI, M. Ochi, Y. Zhao, JAPAN

A transportation system with low pressure drop using spiral flow has been developed. With this system, rice is transported at the rate of 167 kg / hour in a 15.0 m long pipeline that is composed of a 5.0 m vertical section and a 10.0 m horizontal section with 44.0 mm diameter. As a result, the pressure drop is dramatically decreased by about 50% from 5.61×10^2 [Pa/m] to 2.85×10^2 [Pa/m] as compared with the typical method. The high performance transportation is accomplished by steep axial velocity profile and swirling motion of the spiral flow with large free vortex region. The particles in the spiral flow tend not to touch the pipe inner wall.

The device to produce spiral flow is a nozzle with an annular slit, attaching to the conical cylinder. Pressurized fluid is forced through the side of the device into the buffer area and then through the angled annular slit into the conical cylinder. Due to the Coanda effect of this annular jet attaching to the nozzle wall, the flow downstream develops a spiral structure with steep axial velocity distribution and high stability that is much more ordered than typical turbulent flow.

THE STABILITY OF THE FRONT STAGNATION POINT OF HILL'S VORTEX TO A SMALL THREE DIMENSIONAL DISTURBANCE

T. Rozi, JAPAN

The stability of the front stagnation point of Hill's vortex to a small three dimensional disturbance is examined. It's response to a small axisymmetric disturbance (m=0) was investigated by Moffat and Moore. They showed that if the initial disturbance is such as to make the vortex prolate spheroidal, rotational fluid is destrained, forming a thin spike at the rear stagnation point, and if the vortex is initially oblate, irrotational fluid is entrained there. When the initial distortion is not axisymmetric, numerical results for m=4 show that a peak of initial surface elevation moves downstream toward the rear stagnation point forming a spike-like structure. If we use sufficient number of terms (say, several hundreds of terms), except for the rear stagnation point, the response of Hill's vortex seems to decay to the stationary flow.

MAINTENANCE AND MANUFACTURING ENGINEERING

PLANT MAINTENANCE COST REDUCTION BY COST CONTROL PROGRAMME

R. Bhuvanesh, M. Berhan, M. Mohd, MALAYSIA

In today's competitive environment, maintenance plays a significant role in improving the overall profitability of an organisation. Maintenance work raises the level of equipment performance and availability but at the same time it adds to running costs. Maintenance is related to profitability through equipment output and equipment running cost. Industrial plant is now more automated. In addition, the growth in sophistication and in the technological content of maintenance work has made its management more difficult. Because of the high cost of maintenance resources, and of equipment availability, maintenance effort has become a critical factor in company's profitability. This paper discusses about cost of Maintenance, Cost Control Programme, Equipment Cost Control, How to Reduce Plant Cost and Maintenance Cost Control Report.

CONVEYOR BELT MOTION CONTROLLER USING FUZZY LOGIC

E. Dadios, PHILIPPINES

Fuzzy logic system provides a technique of converting a linguistic control strategy derived from expert knowledge into an automatic control strategy. This technique confirms to be very effective on solving problems that are difficult to model mathematically. Over the past decade, fuzzy logic have found applications in many appliances and systems with moderate size and limited number of components. Currently, one of the more active areas of fuzzy logic applications is on control systems.

This paper examines the applicability of using fuzzy logic algorithm to control an off-line multi-input multi-output automated system (a material size sorter). In this automated system, materials of different sizes and quantities are loaded on a conveyor belt moving towards a sorter system. The materials are sorted according to sizes and stored into three different bins (small, medium, and large). The bins are automatically replaced (based on its full capacity) without stopping the motion of the conveyor. The job of the fuzzy logic controller is to control the speed of the conveyor and to decide when to replace the 3 bins. The size of each material is determined using a camera mounted above the conveyor. A computer simulation that displays the automated system on real time is presented.

FILIPINO-OWNED AND MANAGED AUTOMOTIVE COMPANIES: A CASE STUDY IN MANAGEMENT OF TECHNOLOGY

M. Belino, E. de la Cruz, G. Salazar, PHILIPPINES

It is common knowledge that the factors of production include capital, labor, materials, land and technology. Though a very important factor today, technology has to be managed, which means new technology has to be used to create competitive advantages. For a business enterprise to become successful these days, it requires a strategic use of technology for its competitive advantage.

The importance of management of technology led some graduate schools in engineering and business in the Philippines to incorporate a three-unit course in management of technology. Most case study materials on the course, however, deal with experiences of foreign companies in managing technology. While these materials are important to illustrate the concepts on management of technology, the introduction of case studies dealing with Filipino-owned and -managed companies would give the students better insights as far as the applicability of such concepts in Philippine setting is concerned.

The paper attempts to demonstrate the assumption mentioned above. Three Filipino-owned and -managed automotive companies are considered in the case studies that include topics on technological change, research and development, product life cycle and ambivalence of technology. The firms' background, historical development, strategic decisions made about in areas such as product development, manufacturing sales and marketing, and plans and goals for the future are also explored in the case studies. Interviews and plant visits are the methods used in gathering the relevant data.

The extent of the utilization of management of technology in the three automotive firms, and its interaction with the Filipino culture and how such created competitive advantages are determined.

DESIGN AND DEVELOPMENT OF A NEW POWER-DRIVEN STRIPPER HARVESTER WITH RETHRESHER AND CLEANER

R. Bayona, A. Gopez, G. Salazar, PHILIPPINES

Stripper harvesting involves stripping or combing the grain from the crop, leaving the straw anchored to the ground. Reduced straw intake by the machine simplifies threshing and handling of harvested materials. Stripper harvesting is potentially the most energy-efficient method of mechanical harvesting.

A recent research project on the design and development of the stripper harvester has been carried out by a team of mechanical engineering students of De La Salle University. The design was based on the Stripper Harvester (SG800) System developed by a group of Agricultural Engineers from the International Rice Research Institute.

Modifications included the provision of a cross-flow fan/thresher and auger-slinger assembly, installation of a modified power transmission assembly, improved cage wheel and a simplified power transmission system. The stripper harvester unit is currently being powered by a 13-hp Mitsubishi Air-Cooled Engine.

Initial field test have shown that the developed stripper harvester system is able to meet the need for a portable mechanical harvester coupled with rethresher and cleaner in the context of Philippine setting. It must also be taken into account that it allows simultaneous harvesting, threshing and cleaning which reduce the number of workers and operators needed in the harvest season.

The stripper harvester unit is undergoing further testing for evaluation purposes.

GUIDING STRATEGY FOR CONDITION BASED MAINTENANCE

B. Rajamony, M. Berhan, MALAYSIA

Inspection of engineering plant and equipment is necessary to ensure that the plant can continue to carryout its functions and to identify from its conditions whether any maintenance work is necessary. Condition monitoring provides a means of determining whether maintenance is required by selecting a suitable parameter that reflects plant condition, measuring it to determine the degree of deterioration that has occurred, and recording and analysing the results to identify the significance of any changes. It can be contrasted with planned maintenance, where periodic inspections of plant are carried out without measuring specific parameters, and where results can be influenced by individual opinions. Condition monitoring can offer a more efficient method of determining when maintenance is necessary by prediction from measurements, it can thereby reduce unnecessary preventive replacement and provide justifications for extending the plant operating life. It is based on procedures for reporting the results of inspections of those predetermined, measured parameters which are likely to change with time and hence give a realistic indication of plant condition. This paper discusses the guiding strategy which can help determine whether condition based maintenance is justified.

DEVELOPMENT OF AN EXTRUSION MACERATOR FOR RAPID DEWATERING OF WATER HYACINTH (Eichornia crassipes)

E. Calilung, D. Clough, PHILIPPINES

Rapid mechanical dewatering of fibrous vegetative materials like water hyacinth requires separation of the process into two steps of maceration (cell breakage) and moisture extraction, to allow individual optimization for speed and efficiency. To fulfill the first step, a rotary extrusion macerator was designed, fabricated and tested for continuous high-capacity maceration of water hyacinth.

Piston extrusion tests were conducted to establish design parameters for the rotary macerator and to assess extrusion pressure and energy requirements particular to water hyacinth. The test showed that extrusion pressure and energy requirements increased with decreasing extrusion hole pressure of 5971.3 kPa and extrusion specific energy of 1.62 kWh/t was observed for an extrusion hole diameter of 6.35 mm.

Based on the results of the piston extrusion tests, a full-scale rotary extrusion macerator was designed, fabricated and tested in order to establish optimum values for extrusion hole size, roller speed and applied force on the die ring, for maximum moisture extraction rate and minimum energy requirement. Test results showed that best overall performance was attained at maximum roller speed of 200 Rpm, maximum applied die ring force of 2000 kg/hydraulic jack, and maximum extrusion hole diameter of 12.70 mm. At these parameter settings a throughput of 2.02 t/h, moisture extractability of 52.4%, moisture release rate of 0.97 t-H_2O/h, and specific extrusion energy requirement of 3.39kWh/t-H_2O were attained.

LIFE CYCLE ANALYSIS OF MANUFACTURING PROCESSES

A. Culaba, PHILIPPINES

The current patterns of human consumption and behavior are seen to be the main cause to global damage and loss to humanity. Due to rapidly emerging environmental markets, changed customer expectations of product and industry environmental performance as well as the increasingly complex international environmental regulation, environment becomes a vital consideration to industry. Environment does not only affects the tail-end of company operations but it is also central in manufacturing, marketing, distribution, and others. Conversely there are some questions often raised over the role of industrial processes in resource depletion and pollution. How are resources optimised in manufacturing reduce its overall environmental impact, and achieve sustainability? What sort of criteria are looked at and how are these nagging questions. A generalised procedure as well as the development of associated sustainability criteria is presented here. Life Cycle Assessment methodology, which is one environmental management and performance standards currently developed by ISO and CEN, is utilised in this study. An Expert System is developed to generate a self-learning sustainability model for manufacturing industry which include decision-making algorithms for materials usage and forecasting elements for future environmental impact and resource availability.

SHEET METAL HINGES CURLING DEVICE

R. De Lumen, PHILIPPINES

Hinges for various sizes of electrical enclosure require the employ of tooling. To curl or bend one sheet metal hinge requires three chronological stages, thus, utilizing three dies. For large scale manufacturers this does not pose a problem, for them acquiring tools and dies is easy. On the other hand, small and medium scale manufacturers consider this as hindrance to production. The availability of presses is one set-back, thereby setting and re-setting three dies out of one press is taxing and time consuming. Another thing to reckon with is that presses are accident prone machine tools. Operators must work with utmost safety and presence of mind at all time. Power consumption is another financial burden; presses require enormous amount of electrical energy to operate. These are the rationale that motivated the development and fabrication of sheet metal hinges curling device. The tool simplifies the manufacturing of hinges. It is a one hit curling operation with no electrical power consumption, easy and safe to operate/use.

AN EVALUATION OF A LOCALLY DEVELOPED AUTOMATIC TRANSFORMER REWINDER

R. Sandoval, PHILIPPINES

The project Automatic Motor and Transformer Rewinder was conceived to augment the needs in the College of Industrial Education and Electrical Technology Laboratory at the Technological University of the Philippines, specifically in the area of motor and transformer repair and rewinding.

The quest of automation along the service and manufacturing trades has taken great strides and has advanced to new heights. The introduction of sophisticated machines has doubled, even tripled the productivity of Industries with keen preferences to quality. This is the starting point of the conception of the Automatic Transformer and Motor Rewinder. Its main objectives are to turn out outputs at higher rate without sacrifice to quality; to open new challenges in the repair and service field of Electrical Technology; and; to expose faculty and students of the college to modern trends of rebuilding.

The automatic rewinding produced a functionally and acceptable quality of product at a lesser time than conventional rewinding device. In a modern time, quantity and quality are the main focus of attention. Where automation enters productivity begins. The automatic rewinder brings us closer to this desired state.

EXPERIMENTAL AND THEORETICAL ANALYSIS OF DRAW BEAD FORCE (THE PART AND THE EFFECT OF A BEAD TOOL FOR DRAWING)

Y. Kitakaze, G. Kurokawa, M. Hoshino, Y. Uchida, JAPAN

In deep drawing of sheet metal since metal flow in case of box or irregularly shaped parts is not uniform draw beads, a couple of concave and convex tools, are adopted to flow metal uniformly and to prevent products from making defects. A couple of draw beads placed in blank holder surfaces to retard the movement of metal into die cavity. The purpose of this investigation is to establish a method of calculating draw bead force theoretically.

In this investigation effective curvature "K" is proposed, where K is sum of absolute value of incremental curvature which occurred from the entrance to the exit of the bead. And draw bead force increases in proportion to the effective curvature. Draw bead force is determined by K and axial force at the entrance of the bead which is calculated by blank holding force.

Therefore, experimental analysis is carried out to confirm theoretical results. In experimental method one part of draw beads is cut out as a model, 3,4, and 5 mm in height, 10 mm in width, 5 mm in nose radius and in 13 mm in groove width, from a practical die set. Test pieces, mild steel (SPCE) 0.6 0.8 mm thick, 30 mm in width and 300 mm long and stainless steel (SUS 304) 0.6 0.8 mm, 20 mm in width and 300 mm long, are held between couple of beads and are drawn by hydraulic testing machine. Then, draw forces are measured to examine the relations between calculated values and conditions. As a result, both values agree with each other if the test piece doesn't float between bead tools.

FINITE ELEMENT SIMULATION FOR PRESS BENDING OF ALUMINUM EXTRUDED SHAPES WITH INNER PADS

M. Takahashi, M. Hoshino, Y. Uchida, JAPAN

Aluminum alloy cross-sectional shapes will be used for the structures of automobiles more in the future. However, it is difficult to bend aluminum extruded shapes without wrinkles, collapses and

fractures. It is necessary to investigate bendability in several types of bending process for example press bending and draw bending.

In this study, various deformation phenomena which are generated in press bending are simulated by finite element method. It is clear that the distribution of stress and strain in the bending workpieces can be calculated. Compared with the experimental results, the calculated results show the limit bending condition without local deformation which is called wrinkle or collapse. Furthermore, the cross-section of extruded shape is changed to manufacture the necessary curved frames for structure of automobile. To decrease the distortion of flange part of bending workpieces, it is effective that the cross-section of extruded shape is modified for one with a prop. And the collapse does not occur by using pads in the inside of the workpieces. It is difficult to choose the kind of inner pad in order to adjust the hardness of pad stress in bending workpieces. The calculation results show inner pad has effective rigidity. It is proposed that the bending conditions are optimized by finite elemental method.

CHARACTERISTICS OF POWDER EXTRUSION WITH SHEAR STRAIN

M. Hoshino, Y. Uchida, S. Nakamura, JAPAN

Extrusion is used for consolidation of powders. However, small pores are apt to remain in the extruded compacts. A new extrusion method with large shear deformation has been investigated to minimize such residual pores. In this method, powder is compressed into a cylindrical container and extruded through a die with a rectangular exit with changing the flow direction at the right angle to the compression axis once in the single shear process or twice in the double shear process.

The flow of powder in the extrusion process was analysed by simulation experiments and finite element method and numerical simulation based on upper bound theorem. The calculated results show rather good agreement with the experimental measurements. It was shown that the dead zone is formed at the right angle corner in a die and large shear deformation is yielded around the corner. And it was clear that the first shear process has more effects on the total compression than the second shear process.

The density of aluminum compacts extruded with this double shear process reached the value higher than 99 % of that of the ingot made material. Compared with the conventional extrusion, better mechanical properties, higher tensile strength and elongation, can be achieved by this method.

STRENGTH OF MATERIALS

MECHANICAL MODELLING OF THE SUPERELASTIC ARCH-WIRES USED IN ORTHODONTIC TREATMENTS

F. Chinesta, A. Ramon, M Alcaniz, SPAIN

The intention of applying on the teeth a nearly constant force during the orthodontic treatments as well as of returning to the original configuration with independence of the magnitude of the deformation induced in the arch-wires used in the orthodontic treatments have led to the progressive replacement of the classical materials made of steel by new superelastic materials, which present a noticeable non-linearity and whose shape memory properties are associated with a microstructure transformation. This one is the behaviour of the NiTi-alloys, which show different stress/strain diagrams in the loading-unloading cycle (hysteresis).

Although there are scientific works in the numerical simulation of the bending of superelastics arch-wires made of this type of materials, these ones use 3D models in the context of the non-linear elasticity.

We propose an original one-dimensional model based on a generalization of the Maxwell-Mohr integral (obtained from the principle of minimum complementary energy) for the resolution of the direct and inverse bending problems, as a generalization of the classical strength of materials to the non-linear behaviour laws and with hysteresis in the loading-unloading cycle.

The analysis of the solution sensitivity with the loading history allows us to conclude about the possibility of numerical simulation of the orthodontic treatments.

NUMERICAL MODELLING OF CERAMIC FORMING PROCESS

F. Chinesta, R. Torres, A. Portou, I. Mouton, G. Racineux, SPAIN

This paper presents a mathematical model and the numerical techniques used in the simulation of the forming process (roller calibration) of porcelain pieces, in order to evaluate the deject risks , and to decrease the defects rate produced.

As the physical phenomena involved are of different nature, the analysis is presented in different phases: the molding phase, the drying and demoulding phase and the firing phase.

In the molding phase a two-dimensional viscoplastic flow model in the curvilinear coordinates system associated with the shell domain, a function to evaluate the risk of filling defects by occluded air bubbles, and a geometrical analysis of the relives (using a multiresolution wavelet analysis) are developed.

In the drying phase the water diffusion is modeled in the thickness direction, taking into account the boundary conditions imposed by the industrial process. For the spatial discretization a psuedospectral Tchebyshev technique is used while for the time evolution an explicit Euler scheme is proposed. Then the contraction coefficient is calculated. This coefficient determines the maximum depth of the relief to avoid interferences between tie and piece in the demoulding phase.

Obtaining a simplified mathematical model of the firing process is important in order to evaluate the thermal stresses which may produce cracking of the piece. This simplified model (on the thickness dimension) is obtained in the context of the thermomechanics of the continuous medium, using mass and energy balances coupled with the phases change (liquid-aqueous-vapour). The stresses are calculated by means of a thermoelastic simplified model.

GEOMETRICAL NON-LINEAR BENDING PROBLEMS OF THE STRIP FABRICATED FROM THE MULTILAYERED COMPOSITE MATERIAL WITH PERIODICALLY CURVED STRUCTURES

N. Yalnioglu, S. Selim, TURKEY

In the present paper, in the framework of the exact equations of the Geometrically Nonlinear Theory of the Elasticity, the bending of the strip which occupies the region $\Omega = \{0 \le x_1 \le 1; 0 \le x_2 \le h\}$ is investigated. It is assumed that the considered strip is fabricated from the multilayered composite material with periodically curved structures and this curving is taking into account through the continuum approach proposed by Akbarov and Guz'. Otherwise, the strip material is considered as anisotropy inhomogeneous material with normalized mechanical properties. It is supposed that at $x_2 = h$ the uniformly distributed normal forces with intensity p act on the strip and it is considered the following two cases: 1) the strip simply supported at the ends; 2) the strip rigidly supported at the ends.

The above described problem is investigated with employing FEM and the considered nonlinearity is linearized by the use of Newton-Raphson Method. In this case the region occupied by the strip is divided into rectangular Lagrange Family quadratic elements. Note that all investigations are carried out in the framework of the displacement-based FEM and while employing the global smoothing procedure by the help of the Least Square Method a continuously distributed stress field in the considered strip is obtained.

The concrete numerical investigations are made for the case when the considered strip material consists of the two alternating isotrop layer and the influence of the strip material parameters (which characterizes the structure of that) to the stress distribution in that are studied. All programs in the framework of which the present investigation is carried out are composed by the authors in the FTN77, while these programs have been realized on PC.

Using the obtained numerical results the influence of taking into account of the geometrical nonlinearity to the above stress distributions is also determined for the considered problems.

A STUDY ON THE BOND STRENGTH OF PLASMA SPRAYED STEP FGM CR_2O_3 Coatings

H. Kim, I. Oh, I. Kim, S. Kim, KOREA

Plasma sprayed coatings are attractive means to protect components from abrasion wear provided they contain enough hard phases. Because of their hardness and wear resistance, Cr_2O_3 coatings formed on SM43C substrates by the plasma spraying were subjected to annealing or hot press treatment. After each treatment, the bond strengths were

compared with the sprayed coatings. The bond functional gradient layer, and hot press treatment with the step functional gradient layer showed even better results.

STATIC AND DYNAMIC ANALYSIS OF COMPOSITE PLATES WITH DIFFERENT BOUNDARY CONDITIONS

M. Darvizeh, A. Darvizeh, K. Malekzadeh, IRAN

In the present paper an analytical exact method is developed to find out the modal forces, moments and mode shapes of multi-layered composite plates subjected to static and dynamic loading. The composite plates are made of different layers with different fiber angles. The modal forms are presented in the form of double Fourier series. Stokes's transformation is used to legitimize the derivatives of this double Fourier series. By substitution of modal forms and corresponding derivatives to the plate equations, the Fourier coefficients are found. The developed method in this work yields an exact equation which is simpler than the exact method adopted by other research workers. The main advantage of present method is finding the modal forces, moments and mode shapes for plates with different boundary conditions subjected to static and dynamic loading.

The results from present theory are compared with results found form NISAII which is based on finite element method. The agreement is very good.

THE FATIGUE INTEGRITY OF LOAD-HAUL-DUMP MINING MACHINERY

S.P. Claridge, V. Ignatov, T.J. Oliver, UNITED KINGDOM

An international collaborative research programme has been undertaken to investigate the geometrical design, materials selection and the loading environment of various critical structural members of Load-Haul-Dump (LHD) mining machines manufactured in the Ukraine. Using advanced experimental strain analysis techniques, finite element analysis and computational fatigue lifting software (nCode-Fatimas) it was possible to predict the premature in-service fatigue failures of the boom and bucket assemblies of these machines. It was therefore possible to propose a number of recommendations to the operators of these machines to reduce machine downtime and generally increase the operational efficiency.

PULL-OVER STRENGTH IN PROFILED STEEL CLADDING SYSTEMS

L.R.B. Tang, M. Mahendran, AUSTRALIA

High tensile thin profiled steel claddings have widely been used in building industries. When these claddings are crest-fixed and subjected to wind uplift/suction, local pull-over failure occurs due to large stress concentration around screwed fasteners on the crests because of low ductility. This localized failure leads to severe damage to the low-rise buildings and their contents. The design of such a local failure in steel cladding systems is based on full scale testing at the moment. In order to eliminate such a time consuming and expensive exercise, therefore, an investigation was carried out to provide specific design information in indicating the pull-over strength. This paper presents the details of analytical finite element modelling and experimental investigations, and development of simple design formula for crest-fixed steel Trapezoidal claddings.

STABILITY OF COMPOSITE PLATE-STRIP HAVING PERIODICAL CURVINGS IN THE MATERIAL STRUCTURE

Z. Kutug, TURKEY

It is well-known that composite materials are widely used in modern structures, i.e. planes, machines, buildings, etc. Using composite materials in the structures enables them to be more durable, lighter, and stronger. In numerous papers related to the plates made from the layered composite materials the investigations have been made by using a continuum approach in which the pieces wise-homogeneous material of plates has been changed by homogeneous anisotropic material with normalized mechanical properties, and the various refined plate theories have been used. But in those investigations, laminated or fibrous composite materials are generally assumed that they have no curvings in the plate material i.e. the mid-plane of the plate is parallel to the plate surface. But in practice, laminated or fibrous composite plates mostly have some curvings due to production process or design. The effect of these curvings on the plate stress has been analyzed, and a continuum theory was proposed for such composites in which the material structure has been periodical or local curvings.

In this investigation, the effects of the periodical curvings in the plate material on stability of simply supported plate have been examined by using Galerkin Method. Since considered plate has finite length of 1_1 and infinite length of 1_3 in x_1 and x_3 direction, respectively, it is assumed to be platestrip. Periodical curvings in the plate material are in x_1 direction and dimensionless P_{cr} loads act on the plate-strip at its boundary $x_1 = 0$ and $x_1 = 1_1$. Since shear stress can not be negligible in composite structures, a third order refined plate theory has been used in the investigation.

In conclusion, it has been shown that P_{cr} loads are monotonously decreased due to the curvings in the plate material. The greater the curvings in the composite plate material the lower the P_{cr} loads.

THE EFFECT OF THE MATERIAL STACKING SEQUENCE ON THE FRACTURE INSTABILITY OF A THREE (3)-LAYERED COMPOSITE RESISTING THERMAL LOAD

H. Co, PHILIPPINES

This paper is mainly concerned with the fracture instability of a three (3)-layered composite resisting thermal load. Different stacking sequences were analyzed and two types of thermal boundary conditions were considered. The sensitivity of the crack resistance pattern was studied in order to determine the variation of the fracture instability of the multi-layered material system. The physical concepts of the local and global points as well as the characteristic length parameter were introduced to characterize the fracture instability. This concept involved the determination of the local and global stationary values of strain energy density function and their respective locations. The finite element method employing isoparametric elements with cubically varied displacement field was adopted for the thermal stress analysis. The strain energy density contour plots were subsequently obtained and studied. It was observed that for the problem subjected to thermal loading, the characteristics of crack initiation reflected by the local and global points tend to be load dominant. No significant shifts in the location of the local point were observed. Also the optimum stacking sequence, based on the strain energy density criterion was found to be consistent for the two types of thermal boundary condition and conforms to existing work.

BUCKLING ANALYSIS OF MULTI-LAYERED COMPOSITE TUBES SUBJECTED TO DIFFERENT TYPE OF LOADING WITH DIFFERENT BOUNDARY CONDITIONS

A. Darvizeh, M. Darvizeh, K. Malekzadeh, IRAN

In the present paper an analytical investigation is carried out to find static behaviour of composite tubes. A modified exact analytical method is employed to study the buckling problem of high modulus tubes laminated of a composite material. For this purpose Flugge's shell equations modified for anisotropic laminated materials are used. To make the analysis more amenable and more accurate the axial dependence of modal forms is chosen in the form of simple Fourier series. This choice is found to be greatly helpful in the study of the influence of boundary conditions on the various buckling problems of fibrous composite tubes. The results concerning the variation of buckling loads with respect to different fiber angle and changes in geometrical parameters are shown in the form of table and figures.

The results are compared with some available experimental and theoretical results. The agreement between sets of results found to be reasonable.

THE DYNAMIC RESPONSE OF ELASTO-PLASTIC BODY BY FORCED VIBRATIONS

T. Nishimura, K. Matsushima, JAPAN

The dynamic response of perfectly and elastic plastic body is studied. Especially, a spring-mass damped system with one degree of freedom is discussed. It is expected that a stable oscillatory motion of a system is assured, unless the induced plastic deformation does not exceed a certain value, although extensive forced vibration occasionally causes a plastic deformation. Stable and unstable phenomena on oscillatory motion of an elastic perfectly plastic system are resolved concerning the given frequency and amplitude of forced vibration in this paper. The obtained results suggest that the allowable condition against forced vibration may be expanded in an actual structural design, if plastic deformation is permitted.

EXPERIMENTAL VERIFICATION OF PLASTIC FLOW RULE

S. Takeda, T. Nishimura, JAPAN

It is generally believed that a plastic strain proceeds toward the normal direction to the yield surface, that is the normal flow rule. However, there are little experimental researches for verifying the plastic flow rule. Hence, it should be proved whether the normal flow rule is valid or not. The proceeding direction of plastic strain under multi-axial loading paths is investigated experimentally in this study, and it is cleared that the plastic strain proceeds toward the radial direction on the yield curve. Moreover, the proceeding direction of plastic deformation concerning the so-called interaction curve is also investigated under multi-axial loading paths. In this paper, it is concluded experimentally the radial flow rule is reasonable rather than the normal flow rule.

STUDY ON BAUSCHINGER EFFECT UNDER MULTIAXIAL LOADING

Y. Furukawa, T. Nishimura, T. Inoue, M. Komiya, JAPAN

Although so many study of bauschinger effect had been performed under the uni-axial loading, the study of bauschinger effect under the multi-axial loading had hardly been seen. The investigation of bauschinger effect under the multi-axial stress is mentioned in this paper. Since the non linear behavior of work hardening resembles to that of the bauschinger effect in a hardening material, authors employed a mild steel which is regarded as an elastic perfectly plastic material within the yield plateau. The influence of bauschinger effect on the loading and reloading direction is investigated. The influence of bauschinger effect on the loading and reloading direction is cleared by introducing the concept of the *bauschinger ratio*. It is mentioned that the bauschinger effect is strongly affected by the latest loading direction.

STUDY ON THE RESIDUAL MOMENT OF A CIRCULAR PLATE WITH A HOLE

H. Homma, Y. Kato, T. Nishimura, H. Watanabe, JAPAN

The purpose of this study is to investigate how the residual moment caused by the thermal deformation distributes over the plate. The distrubution of the residual moment is closely connected with the plastic deformation, which arises at the periphery of the plate. However, since it is hard to measure the plastic deformation under a high temperature condition, we firstly investigate the behaviour of it at room temperature. From the experimental observation at room temperature, the plastic hinge model that is extending with finite region is suggested. In this paper, we introduce the concept of our suggested plastic hinge model to the thermal stress analysis of the circular plate with a circular hole. The numerical results of the residual moment obtained after cooling process agree well with the experimental results under the clamped condition at the inner periphery. Finally, the numerical analyses of the residual moment are tried to investigate other supported conditions.

MECHANICAL PROPERTIES OF ELECTRON BEAM WELDED JOINTS OF MAGNESIUM ALLOY

T. Asahina, H. Tokisue, JAPAN

Pure magnesium and AZ31 magnesium alloy plates, 4mm in thickness, were butt welded without addition of filler wire using a high voltage electron beam welding machine. Microstructures and mechanical properties of the welded joints were almost free from welding defects and showed good bead appearance under optimum welding conditions. The arcing phenomena have a tendency to appear at low welding speed. Both of the optimum beam current and welding speed were smaller than those of welded aluminum alloy joints. Hardness on the fusion zone of the welded joint are nearly equal to those of the base metals. Microstructure on the fusion zone of welded pure magnesium joint was remarkably coarse, although, the weld interface could not unambiguously detected. Fine crystal grains were observed on the fusion zone of welded AZ31 alloy joint. Regardless of the welding conditions , both tensile strength and ductility of the welded joint show same values to those of the base metals, but the elongation of the welded joint is inferior to those of the base metals. Welded pure magnesium joint fractured at the center of the fusion zone. In case of welded AZ31 alloy joint, the crack occurred at weld interface and it propagated through the fusion zone.

STRUCTURE AND MECHANICAL PROPERTIES OF FRICTION WELDED JOINTS OF AZ31 MAGNESIUM ALLOY TO SUS304 STAINLESS STEEL

K. Katoh, H. Tokisue, JAPAN

AZ31 magnesium alloy was friction welded to SUS304 stainless steel using a braking type friction welding machine. Microstructures and mechanical properties of the friction welded joints were investigated. Appearance and macrostructure of the section of joints indicate that burr develops solely from AZ31 magnesium alloy, seemingly wrapping up SUS304 stainless steel, with no deformation at all occurring in the SUS304 stainless steel. In the SUS304 stainless steel matched with the AZ31 magnesium alloy, hardly any structural change occurred as far as the optical microscopy is concerned. The structure of heat affected zone on the AZ31 magnesium alloy side resembled that of combination similar AZ31 magnesium alloy. The weld layer confined to a limited area, presented a black-looking compound layer, which width was generally about 15 μm with some local variations. Meanwhile EDX analysis indicates that on both materials migration of main elements hardly take place on the weld interface. There is a tendency that the compound layer contains rather little Mg and rather much Al. In view of the analytical results that the compound layer contains about as much elements as the base metal dose, except Mg and Al, it may be assumed that the compound layer develops a eutectic compound of Mg and Al. The hardness on the heat affected zone of welded joint is so negligible that the values may be equated to those of the base metal. The maximum tensile strength of the welded joint shows about 66% of AZ31 magnesium alloy base metal. The elongation of all the welded joints remained less than 1%. All the welded joints fractured at the weld interface.

EFFECTS OF RESIDUAL STRESS ON FRACTURE TOUGHNESS AND SUBCRITICAL GROWTH OF INDENTED CRACKS IN VARIOUS GLASSES UNDER TENSILE AND BENDING STRESSES

M. Yoda, T. Tsutsumi, W. Yasumoto, JAPAN

Fracture and subcritical crack growth are investigated using indented cracks in soda-lime glass, aluminosilicate glass and borosilicate glass. The effect of residual stress is quantitatively evaluated by obtaining the fracture toughness for cracks of various lengths. Extended cracks of various lengths were produced at the same indentation load. From the results, dimensionless indenter-material constants χ_r were determined for the surface crack and depth crack. Subcritical crack growth data for the as-indented short cracks show anomalous behavior, i.e. negative dependence of crack velocity on the stress intensity factor during small crack growth. This decrease in the crack velocity for the as-indented short crack can be explained by taking account of the residual stress. The results of fracture toughness and subcritical crack growth under bending stress were compared with those under tension.

FRACTURE AND CREEP CRACK GROWTH CHARACTERISTICS IN POLYMER FILM

M. Yoda, M. Nabetani, JAPAN

The fracture toughness and creep crack growth rate were measured in the constrained short tension test using centrally cracked films of polyvinylchloride (PVC). The R curves for J_{IC} measurements were obtained by single specimen technique. The creep crack growth rates were measured and expressed in terms of C* parameter. C* is the creep equivalent of the J integral. The experimental data fall into a narrow scatterband independent of load level and crack length. The creep crack growth rate correlates well with C*.

FRACTURE OF HOLLOW PLASTER CYLINDERS UNDER EXTERNAL PRESSURE

A. Hashimoto, M. Terashima, Y. Sato, JAPAN

In order to investigate the fracture of hollow cylinders made of brittle materials under external pressure, plaster was used as the experimental material. We carried out static tests not only of external liquid pressure but also of external gas pressure to examine the influence of pressurizing mediums. In the case of liquid pressure, a local fracture occurred only in one spot on the cylinder. While in the case of gas pressure, the fracture occurred throughout the cylinders, and they were crushed simultaneously. In the case of liquid pressure, the external pressure decreases rapidly due to the leakage of the medium through the section fracture after breaking. However, in the case of the gas pressure, the external pressure does not decrease as rapidly as the liquid pressure, due to the small

bulk modulus of gas. Therefore, the fracture mode of hollow cylinders was found to be different depending upon the pressurizing mediums.

STATISTICAL STRENGTH CHARACTERISTICS OF ALUMINUM ALLOY PIPE AND CARBON STEEL PIPE FRICTION WELDED JOINTS

G. Kawai, K. Ogawa, R. Tsujino, H. Tokisue, JAPAN

In this paper, the strength characteristics of dissimilar material friction welded pipe joints were investigated in order to obtain a reliable set of data for statistical analysis. The weld materials used were #1000, #2000, #5000, #6000 and #7000 aluminum alloy pipes and S25C low carbon steel pipe having 20 mm external diameter and 14mm internal diameter. Thirty specimens of each material were welded. Prior to the experiment the optimum welding conditions were selected for each weld material. The joint strength of each welded joint was examined using a tensile test, and the tensile strength was converted to joint efficiency. The joint efficiency of the welded joints was analyzed using basic statistical analysis at first, then Weibull distribution analysis, and the statistical differences between each type of welded joints were discussed.

The results revealed that the #2000 and #7000 aluminum alloy joints gave lowest joint efficiency having a plus distortion joint efficiency distribution, the #5000 aluminum alloy joint gave medium joint efficiency compared to the other joints tested having a near normal joint efficiency distribution, and the #1000 and #6000 aluminum alloy joints gave the lowest joint efficiency having a minus distortion joint efficiency distribution. The shape parameter m of the Weibull distribution analysis showed that m of the welded #2000 and #7000 aluminum alloy joints was lower than the other tested, m of the semi good welded #5000 aluminum alloy joint was middle range compared to the other joints and m of the good welded #1000 and #6000 aluminum alloy joints was higher than the other tested.

NON-LINEAR ANALYSIS OF DEPLOYABLE MEMBRANE STRUCTURE

Y. Hirose, Y. Nakamura, Y. Miyazaki, JAPAN

Many kinds of flexible structure components have been used in space structures. In particular, cables and membranes are easily deployable and retractable, so that they are used in deployable space structures. As they can not support compressive load, when a compressive force is loaded on them, they will show large wrinkling deformation. Sometimes we need to know their behaviour under compressive loads, for instance, a wrinkling state of a large space antenna during deployment.

In such cases, we usually carry the calculation by investigating whether the applied load is tension or compression. When the load changed to compression from tension, we must change the stiffness of the component to a very small value. It takes a lot of calculation time and contains ambiguity in the value of stiffness.

In this paper, the authors propose a finite element for membrane which expresses the stiffness of the element under both conditions of tension and compression by the same equation, and analyze the behaviour of membrane under compressive load, i.e. in wrinkling state. In order to simulate the wrinkling state, we analyze it as post buckling state, and consider bending stiffness of the membrane. The curvature needed to calculate bending stiffness of the element is obtained by using the coordinates of the nodes close to the element.

STUDIES ON CONE COUPLING

H. Maki, U. Abla, JAPAN

A cone coupling has been frequently used to fix a boss to a shaft in place of a widely known key, especially for a power transmitting system with large torque variation such as a shaft in a diesel engine. Few data, however, have been reported in the literature. In order to obtain fundamental design data, inserting, rotating and extracting experiments for the boss were performed by adopting tapers, Morse taper No.1 and No.2 A direction of processing for a contacting surface of the cone coupling is usually circumferential. A direction of loading in practical use is also circumferential. A direction of inserting, on the other hand, is axial. The extent of wear is closely related to such directions. Three kinds of the typical experimental conditions which varied combinations of surface roughness and hardness were performed. Apparent friction coefficient in the axial and the circumferential directions was discussed in this paper.

EFFECT OF PROCESS CONDITIONS ON THE PRODUCT YIELDS FROM INTEGRATED CATALYTIC UPGRADING AND FLUIDISED BED PYROLYSIS OF PALM SHELL

F. N. Ani, M. N. Islam, MALAYSIA

Biomass is a major source of renewable energy all over the world. Its conversion and utilisation for value-added energy and chemicals are in progress. Of a variety of sources, agro-industrial biomass source is worth mentioning especially in the context of Malaysia. As an industrialised country, it is generating a huge quantity of agro-industrial solid wastes. One of the major producers of this waste is the palm oil mills, about 360 in number, throughout the country. Although this waste has some current usage, however, these practices do not seem to be sound from the points of view of utilisation and environment. Thus an attempt has been taken utilise this waste for improved energy and chemicals recovery. Among these oil palm wastes, oil palm shell has been taken into consideration in this study because of its favourable chemical composition. The palm shell particles are used to obtain liquid oil by an integrated catalytic upgrading and fluidised bed pyrolysis system. The system consists of gas preheater, screw feeder, pyrolytic reactor, cyclone, char collector, catalytic reactor, condenser, liquid collector and gas collector. The pyrolitic reactor is a 30 cm high and 5 cm diameter fluidised bed system while the catalytic reactor is a 30 cm high and 5 cm diameter fixed bed system. The system is made from stainless steel. Gas nitrogen is used as the fluidization medium and silica sand as pyrolytic reactor bed material. The catalyst used in the catalytic reactor is H-ZSM-5. Before using the catalyst it is subjected to acid strength test to find its total acid site strength. The products obtained are: liquid, oil, char, coke and gas. The variable parameters are: catalytic reactor bed temperature and weight hourly space velocity (WHSV). The effects of these parameters on product yields have been studied. The pyrolysis reactor bed temperature is set at 500C with a fluidisation gas flow rate of 1.26m^3/hr-1. A feed rate of 0.18 kg/hr -1 is maintained. The catalytic reactor bed temperature is varied from 350C to 550C and the WHSV is changed from a value of 1 to 3. The product yields are found to be influenced by both the parameters. The liquid is found to be a bright colour single phase product. The liquid was analysed for physical properties.

PREFLAME REACTION UNDER KNOCKING OPERATION IN A SPARK IGNITION ENGINE

K. Akimune, K. Komuro, Y. Ota, T. Matsushima, K. Yoshida, H. Shoji, A. Saima, JAPAN

The emission intensity of the OH (characteristic spectrum of 306.4 nm), HCO (329.8 nm), HCHO (395.2 nm) were measured by emission spectroscopy with the aim of gaining a better understanding of the combustion mechanism of a spark ignition engine. Simultaneous measurements were made on the end gas zone of a combustion chamber. Three types of test fuels were used in this study. The emission intensity waveforms recorded during engine operation on test fuels show indicative the passage and degeneracy of a cool flame and that a blue flame in preflame reaction interval.

THE ENGINE PERFORMANCE OF ULTRA-LEAN MIXTURE IGNITED BY DIESEL FUEL INJECTION

K. Watanabe, D. Kotani, K. Yoshida, H. Shoji, H. Tanaka, JAPAN

We have investigated combustion characteristics of lean gasoline-air pre-mixture ignited by diesel fuel injection using a high compression direct injection diesel engine. Gasoline was supplied as a uniform lean mixture by using carburetors, and lean mixture was ignited by diesel fuel that was directly injected into the cylinder. It was confirmed that the lean mixture of air-fuel ratio between 150 and 35 could be ignited and burned by this ignition method. As the diesel fuel injection increased, HC concentration decreased, and NO_x and CO concentration increased. The exhaust gas emission of pollutants could be reduced when lean mixture was ignited by an optimum diesel fuel injection.

A STUDY ON ACTIVE EFFECT OF OH RADICAL WITH INTERNET EGR

A. Yamazaki, S. Hashimoto, Y. Amino, K. Yoshida, H. Shoji, A. Saima - JAPAN

This research focused on the light emission behavior of the OH radical (characteristic spectrum of 306.4 nm) that plays a key role in combustion reactions, in order to investigate the influence of the

residual gas on autoignition. The test engine used was a 2-stroke engine equipped with a Schnurle scavenging system. It was fitted with an exhaust pressure control valve in the exhaust manifold. Raising the exhaust pressure forcibly recirculated more exhaust gas internally. Emission measurements were made under three conditions: normal combustion without any forced application of internal EGR, forced application of light internal EGR and forced application of heavy internal EGR. When a certain level of internal EGR is forcibly applied, the temperature of the unburned end gas is raised on account of heat transfer from the hot residual gas and also due to compression by piston motion. As a result, the unburned end gas becomes active and autoignition tends to occur.

THE RELATIONSHIP OF GROWTH BETWEEN PLASMA JET AND INITIAL FLAME KERNEL IN PLASMA JET IGNITION

D. Teto, K. Tanaka, K. Yoshida, H. Shoji, A. Saima, H. Tanaka, JAPAN

The investigation regarding performance of plasma jet igniter was explored by using a vessel. In this study, we focused on plasma jet as effects of radicals, and the relationship of growth between plasma jet and initial flame kernel was clarified. In the experiment, plasma jet images were taken with the absence of combustion in the air of atmospheric pressure and room temperature. Propane-air mixture of equivalence ration 1.0 was used for the combustion test, and the initial flame propagation was visualized with the schlieren system. Supplied energies were 24.5 and 50.0 J. The initial flame kernel was created in the plasma region and a few millimeters ahead of plasma jet. The combustion enhancement effect was influenced by the issuing duration of plasma jet and penetration depth of it. The plasma jet and initial flame kernel which were formed in extremely initial stage of combustion influence on the combustion of whole combustion chamber.

DEVELOPMENT OF THE PRACTICAL TYPE PLASMA JET IGNITER

K. Tanaka, D. Teto, K. Yoshida, H. Shoji, H. Tanaka, JAPAN

Plasma jet ignition is the effective method to ensure a certain ignition and combustion enhancement of a S.I. engine operating with lean mixture. The combustion enhancement effects mainly occur toward the plasma jet issuing direction. Therefore, when the igniter is attached at the center of cylindrically shaped combustion chamber, plasma jet should issue toward the round combustion chamber wall. The practical type plasma jet igniter which had a concentric circular orifice has been developed. A concentric circular orifice was formed by a circular orifice and a round plate attached at the tip of the center electrode. The purpose of this study is to elucidate the relationship between plasma jet and igniter configuration. The plasma jet can issue from whole of concentric circular orifice with a certain plasma jet igniter. However, plasma jet issues eccentrically when igniter has large orifice and narrow spark gap width. The luminous area of plasma jet increases with increase of concentric circular orifice area. The penetration of plasma jet increase with increasing in the discharge gap.

ON CATALYST ASSISTED COMBUSTION WITH CATALYST TEMPERATURE LIMITING - EFFECT OF CATALYST ON BLOW-OFF LIMIT OF FLAME STABILIZED BY A CYLINDER -

M. Yamagami, F. Hanba, M. Tanabe, K. Aoki, JAPAN

The effect of catalyst on blow-off limit of flame stabilized by a cylinder is investigated by comparing the catalyst and stainless plates set in a test nozzle. The effect of the cylinder diameter on the limit using the catalyst is also investigated. A structure of the flame stabilized by a cylinder using the catalyst and the stainless is investigated. The research is made by measuring typical gas temperatures distributions in the wake of the cylinder.

A test nozzle whose inner diameter is 50 mm has three catalysts or stainless steel plates which were set parallel to the C_3H_8/Air mixture flow direction. The each set interval is 15 mm. The cylinders were set normal to the plates above the center of the test nozzle. The catalysts plates are made from platinum over stainless steel with γ - alumina wash-coat. The mixture flow has a temperature of 543 K. The outer diameters 'D' of the employed ceramic cylinder are 2.6, 5.0 and 10.0 mm. The distances 'Z' from the exit of the test nozzle to the bottom of the cylinders are set 5 and 10 mm. The burnt gas temperatures in the wake of the cylinders were measured with a silica-coated Pt-30Rh/Pt-6Rh thermocouple.

The difference of the blow-off limit between the catalyst and the stainless is small on the whole.

5mm is the optimum cylinder diameter to hold flame under this experimental condition. The gas temperatures which are distributed in the wake of the cylinder with the catalyst are higher than the temperatures using the stainless. The shape of the flame and the burnt gas temperature at X=0 mm using the catalyst are affected by catalyst.

STUDY ON VORTEX WHISTLE IN SWIRL BURNERS

S. Okamura, Y. Tsuruoka, M. Tanabe, K. Aoki, JAPAN

The mechanism of Vortex Whistle (VW) occurrence was discussed in this paper. The air and fuel flow rates for VW occurrence was investigated experimentally when swirl number is 1.47 with combustion.

The employed experimental apparatus consists of a swirler and a nozzle whose diameter is 100 mm. Fuel propane (C_3H_8), is supplied to the swirler through a fuel injector. The fuel injector is located at the center of the swirler, to jet radially. VW was detected at 200 mm from the exit of the burner by a microphone. The spectrum analysis of pressure fluctuations and sounds were done using FFT (Fast Fourier Transform). Ion current was measured by an ion probe on the nozzle exit plane. The flame structure was estimated from the ion currrent.

The VW occurrence condition with combustion was made clear. In the conditions with and without VW the gradients of the angular momentum differs around the boundary of main and reverse flow.

CONCENTRATION AND VELOCITY MEASUREMENTS IN GAS FLOWS WITH LARGE VELOCITY FLUCTUATION

A. Muramatsu, Y. Era, JAPAN

A probe, which consists of a sonic nozzle and a hot-wire was developed to measure the concentration in the mixing flow of two different gases.

Instantaneous concentration and velocity in the mixing flow can be measured by using the concentration probe and an ordinary hot-wire. In the flow having the large level of velocity fluctuation, however, it has been indicated that the velocity measured by the hot-wire is not accurate. The present study deals with a new method of measurement which a small piezoresistive sensor is used instead of the hot-wire. In this method, the velocity is given from the total pressure measured by the piezoresistive sensor and the density given by the concentration probe. In a pulsating jet where carbon dioxide gas pulsed by a loudspeaker issues into still air, as an example of the flows having large velocity fluctuation, the concentration and velocity were measured.

MEASUREMENT OF SURFACE TENSION OF TEE/E181 AND TFE/NMP BINARY SYSTEM

K. Ogawa, N. Isshiki, H. Koga, T. Nakamura, JAPAN

The objective of this paper is to present information about the surface tension of two binary systems: 2,2,2-trifluoroethanol (TFE)/N-methyl-2-pyrrolidone (NMP) and TFE/tetraethylene glycol dimethyl ether (E181) which are considered to be most important as the working fluids of absorption machines in the near future. Therefore, surface tension was measured, by the differential capillary rise method, over the entire mass fraction range at temperatures of 10 to 40 °C. The experimental values were correlated with temperature and with mass fraction. As a result, the average deviation between the empirical equation and the measured values was less than $\pm$ 0.8% in both cases.

STREAM AND STABILIZING EFFECTS ON DIFFUSION FLAME IN MAGNETIC FIELD

H. Tanaka, K. Yoshida, H. Shoji, A. Saima, JAPAN

The pressure effect on diffusion flames and stabilizing effect were investigated in a magnetic field. The maximum magnetic field strength was applied at 10.35 X 10^5 A/m. Gases receive the pressure which depends on their magnetic properties of flame and surrounding air. The deformation of the flame was discussed, and the stabilizing effect was found in the central portion of the field. Experiments of the flame deformation and the stabilization of flame were made at the center position of the field. The phenomena of the deformation of these gases were attributed to paramagnetic (air) and diamagnetic (flame) properties of gases. The oscillating flame at the center of the field changed to the stabilized one with low frequency, as magnetic field was applied. Flame keeps a constant height of it. Temperature of burned gas in downstream region is higher than when the magnetic field was removed. Time mean intensity

distribution shows that the measured values became higher and the width of the flame became narrower than those as the magnetic field was removed. This is a reason why the stabilizing flame reduces the entrainment of surrounding air with low temperature. Temperature gradient in oxygen diffusion region of the flame is higher than as magnetic field was removed. This means that the distance of the diffusion layer becomes short as magnetic field was applied.

THE DISTRIBUTION OF DIFFUSE AND DIRECT SOLAR RADIATION FROM INDONESIAN CLIMATE

Ir. Sudjito, INDONESIA

A common design procedure and performance evaluation of solar radiation equipment are by short-term field test, followed by computer simulation using long term solar radiation data. The data of global radiation of either diffuse or direct component are required in order that the simulation program be able to calculate energy collated by the solar collector. However, solar radiation data collected by meteorological stations contain global radiation only, and do not measure the diffuse or direct component. Solar radiation distribution model of solar radiation is required, to predict the diffuse or direct component of the measured global radiation. The objective of this project is to develop a solar radiation distribution model, that is suitable for Indonesian climate.

A solar radiation monitoring station has been set up at the Solar Energy Laboratory of Brawijaya University in Malang, Indonesia located at 112°40' East Longitude and 8° South Latitude. The station measures simultaneously global, diffuse, and direct radiation, ambient temperature, and wind speed. The simultaneous measurement of the diffuse and global radiation, is to investigate the correction factor for measurement of diffuse radiation using puranometer with a shadow band ring.

The measurement started in early January 1998 until end of March 1998, for the analysis of solar radiation distribution characteristics, which is be presented in the paper. The measurement of solar radiation data will continue up to 5 - 10 years, to develop a long-term solar radiation data which represents the characteristics of solar radiation for the tropical climate of Indonesia.

Several solar radiation models were already published based on measurement of solar radiation in Canada, the USA, Australia, India, and Singapore. It seems that there are distant differences between models for different climate and locations. Solar radiation model developed by this analysis is useful for the development of solar radiation applications in Indonesia, since there is no representative solar radiation distribution model available.

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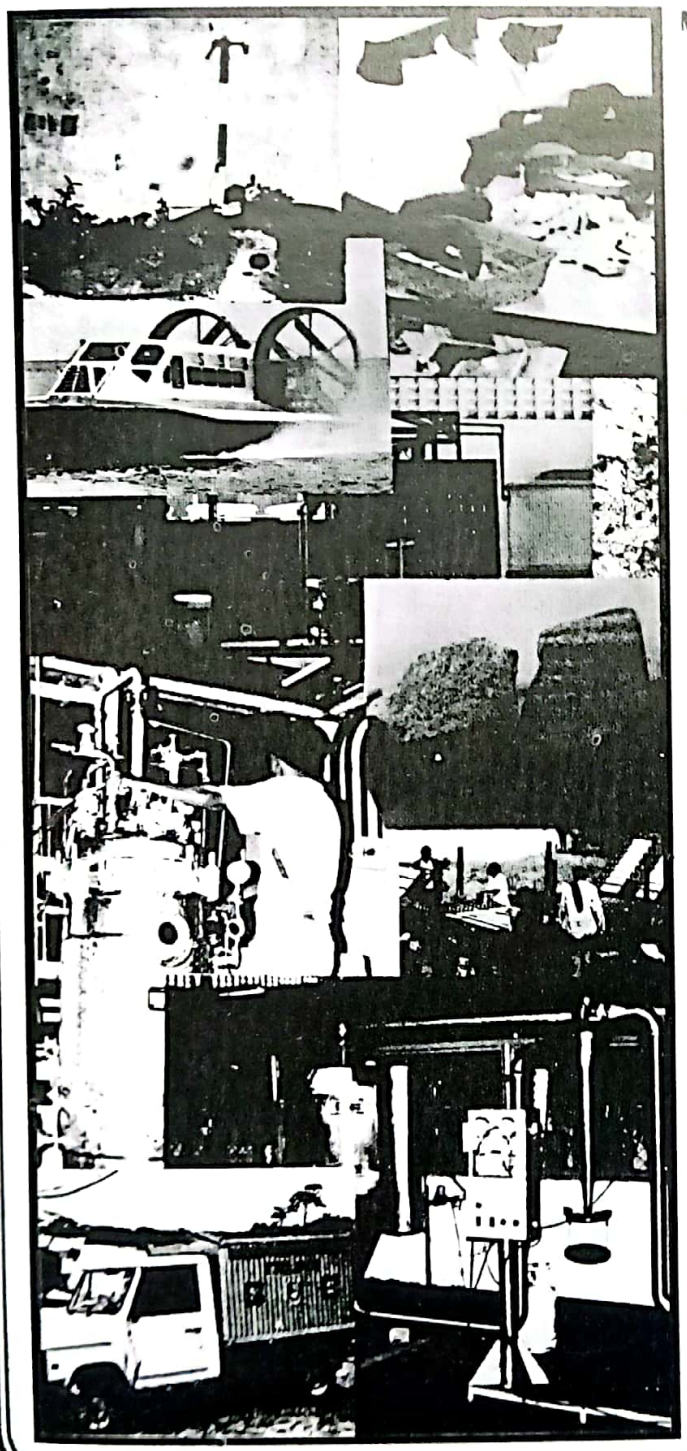
Philippine Council for Industry and Energy Research and Development
Department of Science and Technology

PCIERD was created as part of the reorganized National Science and Technology Authority (NSTA) on March 17, 1982 through Executive Order No. 784

On January 30, 1987, the NSTA was reorganized into the Department of Science and Technology (DOST) through Executive Order No. 128 to make it more effective and responsive to the scientific and technological needs of the country.



Mandate

- Formulate strategies, policies, programs and projects for science and technology (S&T) development
- Program and allocate government and external funds for research and development (R&D)
- Monitor and promote S&T research for applications in the industry, energy, utilities, and infrastructure sectors

S&T Strategies

- Focus R&D on identical high impact technology sectors
- Strengthen private sector participation in R&D and S&T related activities
- Establish networks continuously in the government, industry and academic sectors
- Strengthen linkages with international and non-governmental organizations
- Develop and maintain S&T manpower through MS/PhD scholarship grants

Services

- Grants-in-Aid for approved research proposals to develop processes, products and services in industry and energy sectors with big potentials for practical and commercial applications
- Strengthening the scientific and technological services to industry which include testing quality control services, industrial standards and specifications development, design/production engineering, technical management, consultancy, techno-economic studies, construction and fabrication of prototypes
- Scholarship grants in applied S&T, and
- Reporting of S&T information in industry, energy, utilities and infrastructure for dissemination to end-users

"Committed to Excellence in Technological Education for an Improved Quality of Life and Sustainable Future"

THE TECHNOLOGICAL UNIVERSITY OF THE PHILIPPINES

A Leader in Technological Education in the Philippines in the last Ninety-seven Years

The Technological University of the Philippines (TUP) was started in 1901, upon the establishment of the educational system of the Philippines during the American Regime. It was first known as the Manila Trade School which later became the Philippine School of Arts and Trades (PSAT).

On June 17, 1959 the PSAT was converted into the Philippine College of Arts and Trades (PCAT) under RA No. 2237. After 19 years, the college was converted to the Technological University of the Philippines by virtue of PD No. 1518 on June 11, 1978.

At present, since its conversion into a University, the TUP has four branches: one in the Visayas and three in Luzon. There are 837 personnel to serve an annual average enrollees of 10,500. In 1997 there are 2021 graduates from the various undergraduate and graduate programs.

The TUP provides higher and advanced vocational, technical, industrial, technological and professional education and training in the industries, technology and practical arts leading to certificates, diplomas and degrees. It also conducts applied research and development studies in technical, industrial and technological fields and production using indigenous materials, effecting technology transfer in the countryside and assisting in the development of small and medium scale industries in identified growth centers.

TUP has not stopped with setting forth visions of the institution's growth. Development programs, projects and activities are prioritized in the various sectors. Major considerations are on institutional innovations on curricular programs, making these programs more responsive and relevant to changing technologies

The following are the current curricular offerings in the University:

Doctoral Degree

Doctor of Technology
Doctor of Education, major in Industrial Education Management and Career Guidance
Doctor of Philosophy

Masteral Degree

Master of Arts in Industrial Education, major in Administration and Supervision, Career Guidance and Curriculum and Instruction
Master of Arts in Teaching with fields of specialization in Mathematics, Physics, Chemistry, Practical Arts, Home Economics, General Science and Non-Formal Education
Master in Technician Education
Master in Science in Engineering major in Electrical, Civil and Mechanical
Master in Management
Master in Technology

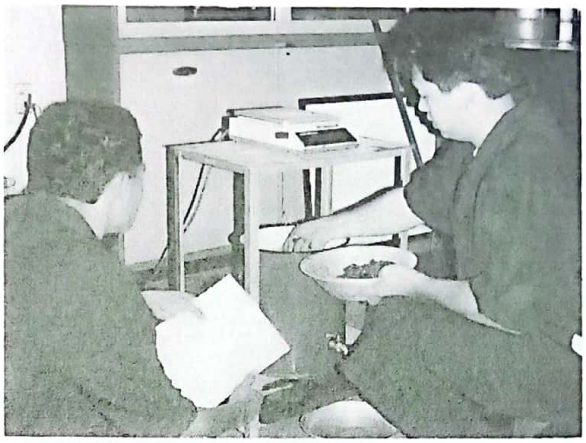
Degree Courses

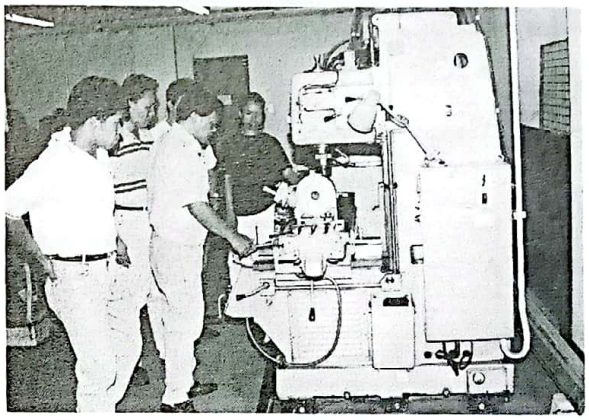
5 Year Degree Courses

Bachelor of Science in Architecture
Bachelor of Science in Engineering

4 Year Degree Courses

Bachelor of Applied Science in Laboratory Technology
Bachelor in Computer Science
Bachelor of Science in Industrial Education
Bachelor of Science in Marine Engineering
Bachelor of Science in Physics Teaching
Bachelor of Science in Computer Education
Bachelor of Technology



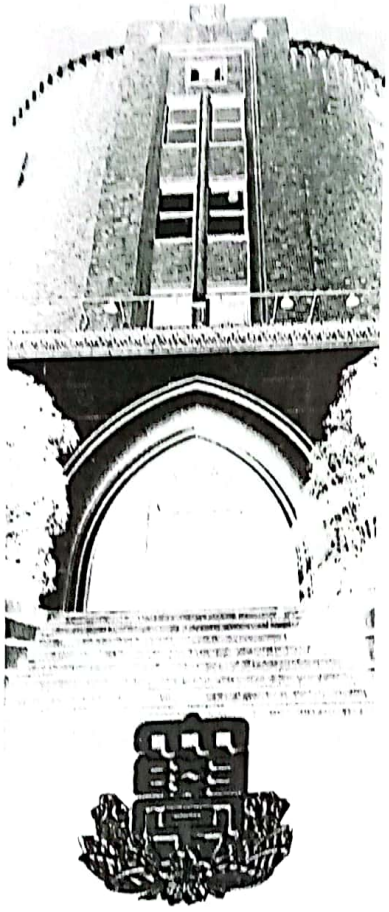


Research activities are pioneering, addressed to high technology products such as tools, materials, and processes required by the country's industrialization program. Extension and outreach services are substantially relied upon to provide access to adequate information on technology and industrial development.

The faculty and staff are recognized for their advanced educational preparation, experience, competence and expertise. Their professional services as consultants and resource person are highly sought after. TUP facilities, tools and equipment are more than adequate and may be availed of by other institutions involved in training and research.

By the year 2000, TUP shall be a highly relevant, responsive and productive institution, maintaining its role as the center of excellence in higher and advanced technological education, research and extension.

Nihon University
COLLEGE OF SCIENCE AND TECHNOLOGY



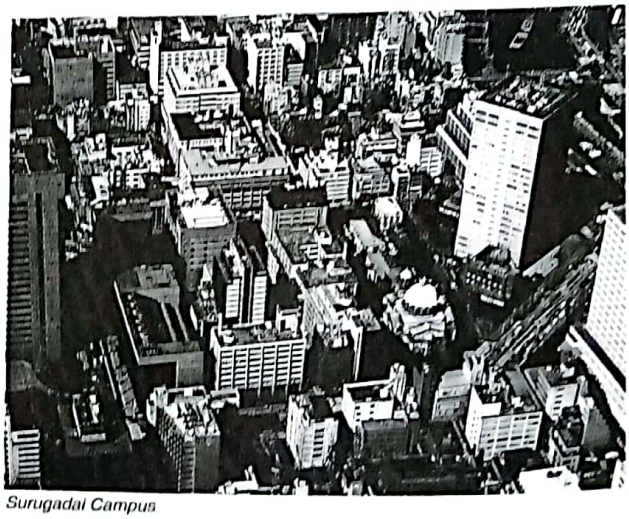
NIHON UNIVERSITY

Nihon University was founded as a private educational institution in 1889 by Akiyoshi Yamada, then Minister of Justice. It is now one of the leading universities in Japan which is composed of 15 graduate schools, 14 colleges, a correspondence division, a junior college and 18 departments, numerous research institutes, attached school, special training schools, and hospitals, with a total of 86,000 students an 8,300 faculty members. It aims to contribute to the world peace and the welfare of humanity by relying on the Japanese spirit, valuing the Confucian system, abiding by the constitution, cultivating the spirit of independent creativity, and by working for the development of culture. The mission of Nihon University is to develop cultured people who are sound of mind and body and conduct in-depth academic research by gathering a broad-range of knowledge from around the world.

COLLEGE OF SCIENCE AND TECHNOLOGY

The College of Science and Technology was founded in 1920. Today, the college has 12 departments, 17 graduate programs, and a junior college with three departments. The college has two campuses with a total of 361,000 square meters, and 12,000 graduate and undergraduate students and a faculty of 630.

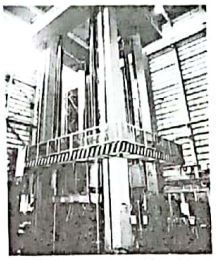
The curriculums are designed to widen students' intellectual horizons, as well as provide them with highly specialised knowledge and skills in their respective fields. This is achieved through a balance among the liberal arts and humanities, and the natural and social sciences.



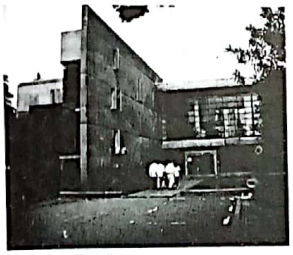
Surugadai Campus

Since its establishment in 1920, the College has sent out 160,000 graduates and 836 doctors into society to contribute to the development of science and technology. These figures represent a top-level result for a single department of science and technology of a private university.

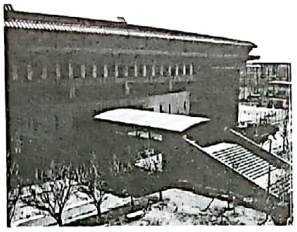
Advanced Materials Science Center



3000tf Structure Machine



Funabashi Library



Sports Hall

In addition, each year about 10 foreign undergraduates and about 15 foreign graduate students have been admitted, mainly from Asian nations. As a college so highly evaluated in every aspect of education and study, we consider our responsibility and duties for the future science and technology to be great.

With industry becoming more complicated and advanced, human resources with originality and problem-solving abilities are required in various fields. In order to meet the needs of society, we have reviewed and improved our curricula. The 12 departments and 17 graduate courses of our college welcome you who will lead science and technology in the 21st century.

GRADUATE SCHOOL OF SCIENCE AND TECHNOLOGY

The Graduate School of Science and Technology, Nihon University, traces its history to the Graduate School of Engineering, which was founded in 1951 as part of what was then called the College of Engineering. At that time, the school offered master's courses in four disciplines: construction engineering, mechanical engineering, electrical engineering, and applied chemistry. Doctoral courses were added in these disciplines in March 1953. Ten years later, courses were added in physics and mathematics, and geography; and the name of the school was changed to the Graduate School of Science and Technology. Since then, the school has continued to develop, so that today it offers masters and doctoral courses in a total of 17 disciplines.; Civil Engineering, Transportation Engineering, Architecture, Oceanic Architecture and Engineering, Mechanical Engineering, Precision Machinery Engineering, Aerospace Engineering, Electrical Engineering, Electronic Engineering, Industrial Chemistry, Physics, Mathematics, Geography, Real Estate Science, Medical Care-Welfare Engineering, Computer Science and Quantum Science and Technology.

The school has a faculty of 167 professors who act as graduate advisors. Associate professors, lecturers, and other assistants also provide research guidance, making it possible for each student to receive thorough, personalized instruction. At present 938 students are registered on the master's course and 111 students are registered on the doctoral course. To date, the school has awarded 7325 master's degrees and 298 doctorates. In addition, the school examines the dissertations submitted by researchers who have done their work elsewhere; it has awarded 579 doctorates on this basis.

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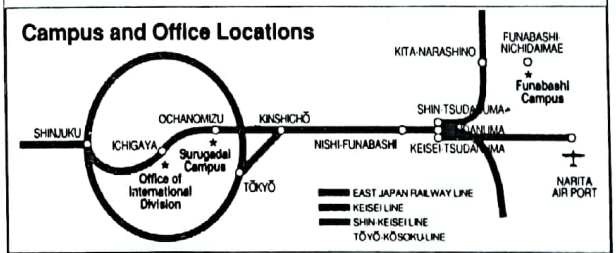
home page: http://www.cst.nihon-u.ac.jp



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E-mail: guide@hq.cst.nihon-u.ac.jp FAX +81-3-3293-5829

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1997 09

UNIVERSITY OF THE PHILIPPINES

Propelling the Nation Towards Globalization

UP System President
Dr. Emil Q. Javier

The national university

The premier institution of higher learning in the country, the University of the Philippines (UP) was established in 1908 with a mandate "to provide advanced instruction in literature, philosophy, the sciences and arts and to give professional and technical training to every qualified student regardless of age, sex, nationality, religious belief or political affiliation."

As the national university, UP is inspired by a vision to be the apex and base of the Philippine educational system, a key instrument for national development and a significant participant in the international community.

A Strong Union of Autonomous Universities

Today, UP has evolved into a "multi-versity" composed of six autonomous universities with the flagship campus located in Diliman, Quezon City. The other constituent units are: UP Manila, UP Los Baños, UP Visayas and, created only in early 1995, UP Mindanao and the UP Open University. The Open University broadens access to quality higher education through self-study programs designed for students who wish to study by distance mode.

While each unit is identified by specific areas of specialization, particularly through its centers of excellence, the University draws strength from the intricate balancing of unity and diversity among its constituents.

Leadership in S&T Development

UP boasts of a teaching force of 1,045 Ph. D. degree holders in the natural sciences, engineering and other professions. Responding to the need for professionals who would lead scientific and technological activities in the country, the Philippine government established a system of national centers of excellence in the physical and biological sciences within UP. It includes a network of biotechnology institutes based in UP Diliman, Los Baños, Manila and the Visayas. The network - known as the National Institutes of Molecular Biology

and Biotechnology focuses on agricultural, medical, industrial and environmental applications of biotechnology and boasts of a core faculty of well-trained Ph.D. degree holders and excellent physical facilities and laboratory equipment. Its programs receive government support and, in turn, benefit private industry and the government sector. Apart from this network, UP also has strong research programs at each of its campuses:

UP Diliman: hydraulic engineering, material science, physics, marine science

UP Los Baños: computer science, plant breeding, forest ecology, veterinary medicine

UP Manila: Hepatitis research, schistosomiasis research, public health

UP Visayas: fisheries, aquaculture

Aristocracy of Brains and Character

UP's S&T thrust is tempered by an equal emphasis on values education which begins with an early undergraduate curriculum that is well-grounded in the humanities and social sciences. UP also maintains its role as national university by constantly enriching the Filipino language, values and culture components of its educational programs. UP maintains the Sentro ng Wikang Filipino (Center for Filipino Language), a system-wide research and training center which is committed to the enrichment and cultivation of the national language.

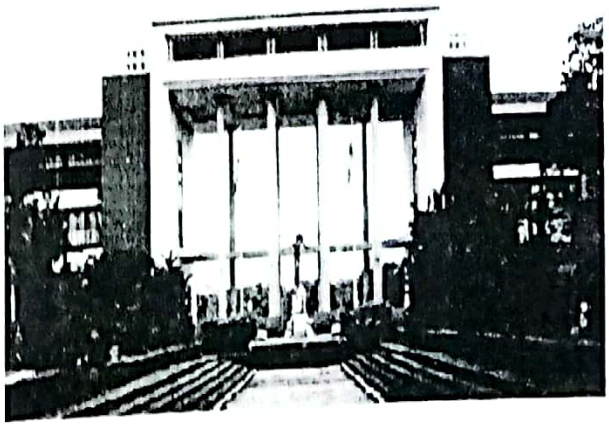
In view of the Philippines' multi-ethnic make-up, the University promotes cultural diversity through its Regional Studies Programs on Mindanao, the Cordillera and West Visayas which are socio-cultural and political-economic in scope.

UP is also home to a number of internationally acclaimed performing groups which have been recognized to be the best in their field, such as the UP Madrigal Singers and the UP Concert Chorus.

Outside of the classroom, state scholarship extends to voluntarism and public service institutionalized by the UP Ugnayan ng Pahinungód/Oblation corps which now has over a thousand volunteers deployed in the government agencies and various welfare institutions and communities around the country. The Ugnayan ng Pahinungód is values education in action, epitomizing self-offering in the service of country.

Towards a New Century

The University of the Philippines is looking forward to it first centennial, the year 2008, just over a decade away. At this critical juncture in its history, it is determined not to lose sight of its vision - as a university responsive to the forces of globalization and high technology on the one hand, and on the other, to the demands of the unique character of the Filipino tradition and heritage, as it continues to make its singular contributions to the world. ■



UP as "multi-versity":
UP's flagship campus in Diliman, Quezon City

De La Salle University
Mechanical engineering

Energy. Manufacturing. Design. Automation. Four of the technologies to enable a mechanical engineer to deal with gadgets from simple can openers to complex space crafts. The Mechanical Engineering program of De La Salle University teaches students and professional engineers the rudiments of the science, and how to translate theory into practicable gadgets and tools. The 21st century mechanical engineer designs and manufactures tools taking strong regard of the future needs of society.


Students learn the mechanics of energy in the mini-steam power plant.

Research plays a major component in the life of mechanical engineering students. It takes students from their classrooms to agricultural towns, sugar mills, or to rustic provinces. Along with faculty advisers, a group of students developed a harvester which is capable of harvesting, threshing, cleaning, and bagging rice, all in one step as the machine runs through the field. This trailblazing gadget, which won the Sibol Awards from the Department of Science and Technology, increases efficiency since it cuts the farmers' work time in half.


Innovation spells DLSU mechanical engineers. The harvester was developed to increase efficiency in the rice fields.

La Salle mechanical engineering students also gave the residents of Malibcong, Abra the first spark of electrical light. These engineers developed a micro-hydro power plant which supplied the power to provide electricity in the area. The invention of the mini-power plant manifests the students' ingenuity of harnessing natural resources available and tapping the power of science.

Even as the country move toward a sustainable type of development, mechanical engineers will have to be future-oriented-- serving to make industries run on the one hand, and working to preserve the natural environment on the other. For ME is all about kinematics, dynamics, computers, computer-aided design and computer-aided manufacturing (CAM-CAD), machine design, heat transfer and thermal dynamics, materials science and mechatronics, and environmental science.

Both the undergraduate and graduate ME programs steep its students into these elements and allow for the integration of these into the work mechanical engineers do for industry or for other sectors. Holistic and encompassing, the ME programs develop the engineers of the future.

TCGI ENGINEERS

TCGI ENGINEERS is an independent, employee-owned engineering consulting firm based in Makati, Metro Manila, Philippines. The firm's initial activities involved the design and supervision of the construction of a number of industrial and commercial projects in the country.

Since its founding in 1973, the firm has grown steadily, both in terms of staff and multi-discipline expertise. Today, TCGI draws its strength from the experience of 25 years of providing integrated engineering services in the planning, design and implementation of industrial, commercial and institutional projects including public infrastructures to the government and private sectors, both in the Philippines and overseas, particularly in Kuwait, Hawaii, the Republic of Palau and other islands in the Pacific and Micronesia.

The firm's standard of professional integrity and quality performance may be gleaned from the high percentage level of repeat project engagements from satisfied clients who, time and again, return to the company for project assistance. Also, the company has won a significant number of projects from new clients as a result of strong referrals from its satisfied customers.

TCGI's full-time staff of over 500 multi-discipline and widely experienced engineers and technicians is complemented by more than 50 specialist consultants who are available to the company on an on-call basis. To further broaden its professional base and collective expertise, the firm also maintains close working relationships with leading specialist firms on a project-by-project basis.

SCOPE OF SERVICES

The services provided by the firm cover the various stages of project development as follows:

Feasibility Study
- o Site Investigation & Selection
- o General Development Studies
- o Soils & Materials Survey
- o Conceptual Design
- o Budgetary Estimates
- o Master Planning

Engineering Design
- o Detailed Design
- o Construction Plans & Drawings
- o Contract Documentation
- o Construction Scheduling
- o Technical Advice

Construction Management
- o Bid Analysis & Awards
- o Planning & Scheduling
- o Construction Monitoring & Evaluation
- o Quality Inspection & Control
- o Commissioning & Start-up
- o Post Construction Services

Specialized Services
- o Environmental Impact Studies
- o Maintenance Planning
- o Seismic Design & Studies
- o Soils/Geologic Studies
- o Surveying & Mapping
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- o Value Engineering

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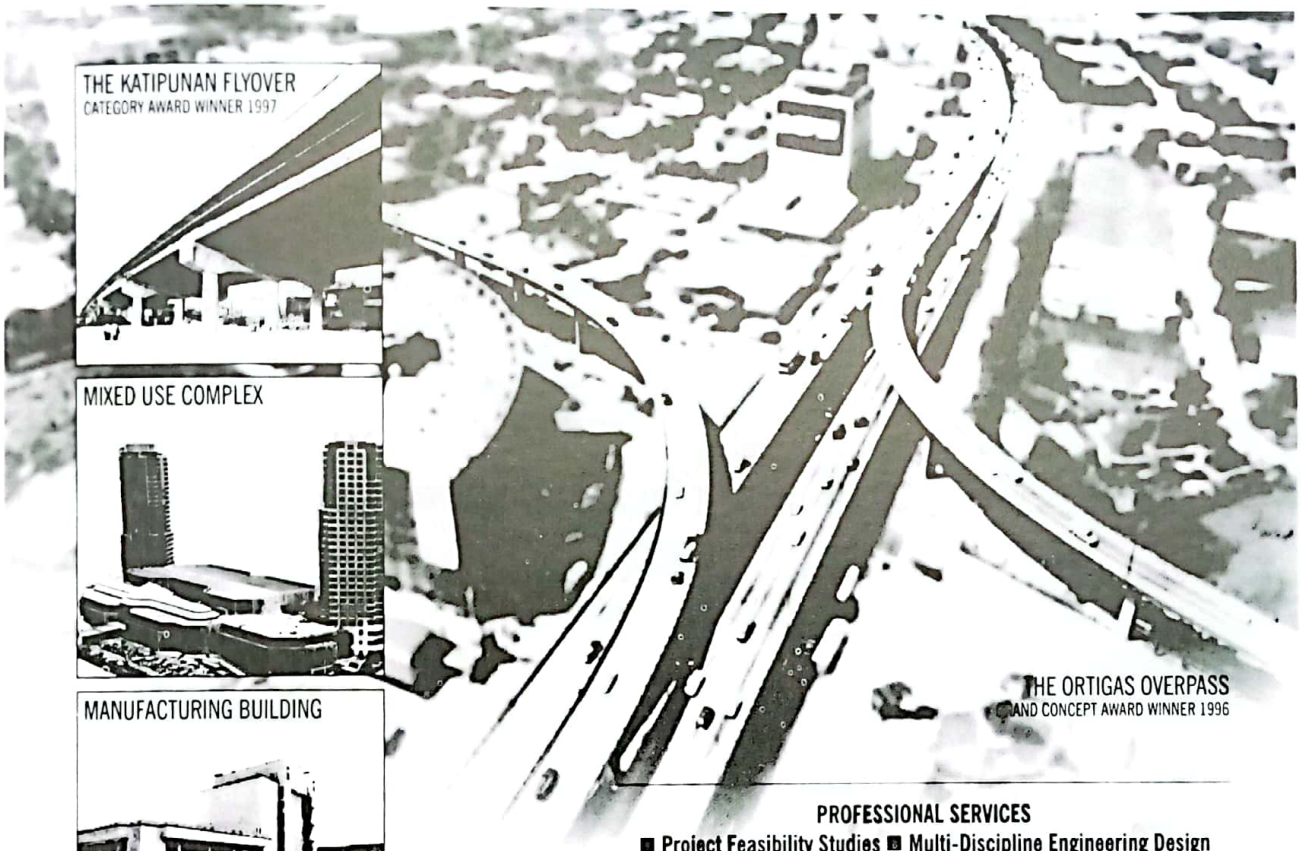

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■ **Construction Management and Supervision**

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— Industrial plants, factories — Electro-Mechanical Systems

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— River Regulation and Control — Municipal Water Supply Systems
—Sewerage — Waste Management/Disposal — Agribusiness

■ **Transport Systems**

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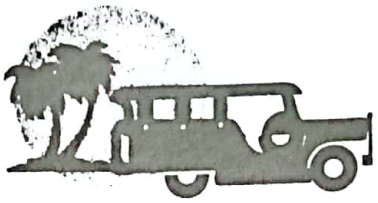

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