



Vol. 67, No. 1, March 2006
KDN PP5476/7/2006 ISSN 0126-513X

MAJLIS BAGI SESI 2005/2006 (IEM COUNCIL SESSION 2006/2007)

YANG DIPERTUA / PRESIDENT:

Y. Bhg. Datuk Ir. Prof. Dr Ow Chee Sheng

TIMBALAN YANG DIPERTUA / DEPUTY PRESIDENT:

Y. Bhg. Datuk Paduka Ir. Hj. Keizrul bin Abdullah

NAIB YANG DIPERTUA / VICE PRESIDENTS:

Y. Bhg. Dato' Ir. Prof. Dr Chuah Hean Teik, Ir. Prof. Dr Ruslan bin Hassan, Y. Bhg. Dato' Ir. Hj. Abdul Rashid bin Maidin, Ir. Tan Yean Chin, Ir. P. E. Chong, Ir. Assoc. Prof. Megat Johari bin Megat Mohd. Noor, Ir. Yim Hon Wa

SETIAUSAHA KEHORMAT / HONORARY SECRETARY:

Ir. Oon Chee Kheng

BENDAHARI KEHORMAT / HONORARY TREASURER:

Ir. Lee Weng Onn

WAKIL STRUKTUR / STRUCTURAL REPRESENTATIVE:

Ir. Dr Jeffrey Chiang Choong Luin

WAKIL AWAM / CIVIL REPRESENTATIVE:

Ir. Haji Samsuddin bin Ismail

WAKIL ELEKTRIK / ELECTRICAL REPRESENTATIVE:

Ir. Mah Soo

WAKIL MEKANIK / MECHANICAL REPRESENTATIVE:

Ir. Gopal Narian Kutty

WAKIL KIMIA DAN DISIPLIN LAIN / CHEMICAL AND OTHERS REPRESENTATIVE:

Ir. Juarez Rizal bin Abd. Hamid

AHLI MAJLIS / COUNCIL MEMBERS:

Ir. Adnan bin Zulkiple, Ir. David Lai Kong Phooi, Ir. Manogaran a/K. Raman, Ir. Hj. Mohd. Hassin @ Mohd. Hashim Daud, Ir. Assoc. Prof. Lt. Kol. Mohd. Hazani bin Hj. Shafie, Ir. Mohd. Rasid Osman, Ir. Woo Ah Keong, Ir. Yeo Boon Kah, Ir. Yusouf bin Ahmad, Ir. Muhammad Imran bin Baharuddin, Ir. Dr Norida binti Bunyamin, Ir. Vincent Chen Kim Kieong, Ir. Dr Tan Yean Guan, Ir. Dr G. Balamurugan s/o B. Gurusamy, Ir. Patrick Cyril Augustin, Ir. Major (R) Hj. Ahmad Mazlan bin Othman, Ir. Choo Kok Beng, Ir. Abdul Rahim bin Hj. Othman, Ir. Ahmad Nazari bin Ashari, Ir. M. C. Hee, Ir. Lee Eng Choy, Ir. Hj. Mohamed Ali bin Yusoff, Ir. David Ng Shiu Yuen, Ir. Dr Ramlee bin Karim, Ir. Luk Chau Beng, Ir. Lim Ah Hang, Ir. Rocky Wong Hon Thang

BEKAS YANG DIPERTUA TERAKHIR / IMMEDIATE PAST PRESIDENTS:

Ir. Prof. Abang Abdullah bin Abang Ali

BEKAS YANG DIPERTUA / PAST PRESIDENT:

Y. Bhg. Tan Sri Ir. (Dr) J. G. Daniel, Y. Bhg. Dato' Ir. Pang Leong Hoon, Ir. P.E. Chong, Y. Bhg. Datuk Ir. (Dr) Hj. Ahmad Zaidee bin Laidin, Ir. Dr Gue See Sew

PENGERUSI CAWANGAN / BRANCH CHAIRMAN:

1. Pulau Pinang – Ir. Vincent Tan Hui Meng
2. Selatan – Ir. Amir Hashim bin Mohd. Kassim
3. Perak – Engr. Khairul Anwar bin Masud
4. Timur – Y. Bhg. Dato' Engr. Hj. Annies bin Md. Ariff
5. Terengganu – Engr. Hj. Ghazali bin Hashim
6. Negeri Sembilan – Engr. Hj. Ahmad Husaini bin Hj. Sulaiman
7. Melaka – Engr. Mohd. Salleh bin Yunus
8. Sarawak – Engr. Zawawi bin Embong
9. Sabah – Engr. Joe Chow Wai Ming
10. Miri – Engr. Chiew Chung Lee
11. Kedah-Perlis – Engr. Hj. Ahmad Zakiiyuddin bin Abd. Rahman

AHLI JAWATANKUASA PENERBITAN / STANDING COMMITTEE ON PUBLICATIONS:

Pengerusi / Chairman: Ir. Prof. Dr Ruslan bin Hassan
Naib Pengerusi / Vice Chairman: Ir. Manogaran s/o K. Raman
Setiausaha / Secretary: Ir. Assoc. Prof. Dr Junaidah binti Ariffin
Pengerusi (Perpustakaan) / Library Chairman: Ir. Dr Luqman Chuah Teong Guan
Ahli-Ahli / Committee Member: Ir. Chin Mee Poon, Ir. Mah Soo, Ir. Look Keman bin Hj. Sahari, Ir. Dr Jeffrey Chiang Choong Luin, Ir. Lau Tai Onn, Ir. Dr Zahurul Faizi bin Hussien, Ir. Dr Ramlee bin Karim, Ir. Dr G. Balamurugan s/o B. Gurusamy, Engr. K.H. Man

LEMBAGA PENGARANG / EDITORIAL BOARD:

Ketua Pengarang / Chief Editor – Ir. Chin Mee Poon
Pengarang (Bulletin) / Bulletin Editor – Ir. Mah Soo
Pengarang (Jurnal) / Journal Editor – Ir. Assoc. Prof. Dr Aminuddin bin Mohd. Baki
Setiausaha / Secretary – Ir. Assoc. Prof. Dr Junaidah binti Ariffin
Ahli-Ahli / Committee Member – Ir. Look Keman bin Hj. Sahari, Engr. K.H. Man

AHLI JAWATANKUASA JURNAL / SUB-COMMITTEE ON JOURNAL:

Pengerusi / Chairman: Ir. Assoc. Prof. Dr Aminuddin bin Mohd. Baki
Ahli-Ahli / Committee Member: Ir. Assoc. Prof. Dr Junaidah binti Ariffin, Ir. Mohd. Taufik bin Salleh, Ir. Mohd. Zawawi bin Ahmad, Ir. Dr Jeffrey Chiang Choong Luin, Dr Muhammad Azmi bin Ayub, Engr. Khairul Rijal bin Jamaludin, Puan Zubaidah binti Ismail

THE INSTITUTION OF ENGINEERS, MALAYSIA

Bangunan Ingenieur, Lots 60 & 62, Jalan 52/4, P.O. Box 223,
(Jalan Sultan) 46720 Petaling Jaya, Selangor.

Tel: 03-7968 4001/4002 Fax: 03-7957 7678

E-mail: sec@iem.org.my Homepage: http://www.iem.org.my

Printed by : SETIAKAWAN PRINTERS SDN. BHD.

NO. 5 & 7, Jalan Industri PBP 11,

Taman Industri Pusat Bandar Puchong, 47100 Selangor Darul Ehsan, Malaysia.

Tel: 603-5891 7363 Fax:603-5891 7232/33 E-mail: skpsb@tm.net.my

CONTENTS

- 1 Two Dimensional Data Modeling and Chebyshev Approximation of Spline
by Fauziahanim Che Seman, ShahNor Basri and Ahmad Faizal Mohd. Zain
- 10 System Analysis of Efficient Production Processes for Productivity Enhancement through Productivity Balance in Injection Moulding Process
by R.Usubatov, S.M. Sapuan, M.M.H.M. Ahmad and N. Ismail
- 15 A Study on Interference of Surface Model Footings Resting on Sand
by Iqraz Nabi Khan, K.C.Bohara, M.L.Ohri and Alam Singh
- 24 Effect of Sonification for In-Situ Stainless Steel Leaf Filtration
by Ahmad Ziad Sulaiman and Rosli M.Y.
- 30 Isomerisation of Cyclohexane to Methylcyclopentane Over Pt/SO₂-Z₂O₂ Catalyst
by Sugeng Triwahyono, Aishah Abdul Jalil and Halimatun Hamdan
- 36 Hazard Rating of Substances Systems Developed By NIOSH'S RTECS-NOHS and USEPA
by Law Puong Ling, Michael J. Ellenbecker and Ng Chee Khoo
- 43 Distributed Model for Changes in River Peak Flow Due to Land Development
by Y.M.Mustafa, M.S.M Amin, T.S. Lee and A.R.M. Shariff
- 49 Cycloconverter-Type High Frequency Link Inverter for Photovoltaic Application
by Zainal Salam, Nge Chee Lim, Toh Leong Soon and Mohd. Zulkifli Ramli
- 57 Systematic Design of A Maximum Water Recovery Network for an Urban System Based On Pinch Analysis
by S.R. Wan Alwi, Z.A. Manan and Z. Ujang

INTERNATIONAL ADVISORY PANEL

Prof. J. M. Owen
University of Bath, UK

Prof. Don Mclean
University of Southampton, UK

Prof. Hiroshi Yabe
University of Kyoto, Japan

Prof. M. Rodds
University of Wales, UK

Prof. A. J. Saul
University of Sheffield, UK

BRANCHES

HEAD- QUARTERS	THE INSTITUTION OF ENGINEERS, MALAYSIA BANGUNAN INGENIEUR, LOT 60/62, JALAN 52/4 PETI SURAT 223, 46720 PETALING JAYA, SELANGOR	TEL: 03-7968 4001 7968 4002 FAX:03-7957 7678 sec@iem.org.my
PENANG	IEM NORTHERN BRANCH LEVEL 5, 5-A NORTHAM VENTURE, 37 JALAN SULTAN AHMAD SHAH, 10050 PENANG	TEL: 04-818 2045 04-808 2046 FAX:07-331 9710 iempenang@po.jaring.my
SOUTHERN	IEM SOUTHERN BRANCH NO. 24-B, JALAN ABIAD, TAMAN TEBRAU JAYA, 80400 JOHOR BAHRU, JOHOR	TEL: 07-331 9705 FAX:07-331 9710 iemsouthern@gmail.com
PERAK	IEM PERAK BRANCH CITY PERUNDING SDN BHD 67A, JALAN ROKAM, PEKAN RAZAKI, 31350 IPOH, PERAK	TEL: 05-312 2120 FAX:05-313 8001 khairulamasud@yahoo.com
EASTERN	IEM EASTERN BRANCH C/O. IR HJ MOHAMAD AZMAN BIN HJ AHMAD KETUA PENOLONG PENGARAH KANAN ELEKTRIK JKR CAWANGAN ELEKTRIK, JALAN KEMUNTING 2 SERI KEMUNTING, 25100 KUANTAN, PAHANG	TEL: 09-513 3533 FAX:09-514 1594 mazman@jur.gov.my
TERENGGANU	IEM TERENGGANU BRANCH IR. HJ GHAZALI BIN HASHIM D/A JABATAN KERJA RAYA TERENGGANU, TINGKAT 12, WISMA NEGERI, 20200 KUALA TERENGGANU, TERENGGANU	TEL: 09-627 4003 FAX:09-627 4004 ghazali@jkr.terengganu.gov.my
NEGERI SEMBILAN	IEM NEGERI SEMBILAN BRANCH No. 28-1, JALAN DURIAN EMAS 4, BETARIA BUSINESS CENTRE, OFF JALAN DATO' SIAMANG GAGAP 70100 SEREMBAN, NEGERI SEMBILAN	TEL: 06-767 7333 FAX:06-767 7000 prdesign@tm.net.my
MELAKA	IEM MELAKA BRANCH 2, JALAN MELINJA 2, TAMAN MELINJA, BUKIT BARU, 75150 MELAKA	TEL: 06-284 8028 FAX:06-283 8919 spoesb@gmail.com
SARAWAK	IEM SARAWAK BRANCH ULTIMATE PROFESSIONAL CENTRE 2ND FLOOR, 16 JALAN BUKIT MATA KUCHING, 93100 KUCHING, SARAWAK	TEL: 082-428 506 FAX:082-243 718 iemsb@po.jaring.my
SABAH	IEM SABAH BRANCH LOT 24 AND 25, 3RD FLOOR, BLOCK C, DAMAI POINT COMMERCIAL CENTRE, LORONG DAMAI POINT, OFF JALAN DAMAI, 88100 KOTA KINABALU, SABAH	TEL: 088-236 749 FAX:088-236 749 iemsabah@sabah.org.my
MIRI	IEM MIRI BRANCH LOT 2935, 2ND FLOOR, FARADALE COMMERCIAL CENTRE, JALAN BULAN SABIT, 98000 MIRI, SARAWAK	TEL: 085-438 178 FAX:085-438 196
KEDAH-PERLIS	IEM KEDAH-PERLIS BRANCH CAWANGAN KEDAH-PERLIS, NO. 135C, 2ND FLOOR, KOMPLEKS ALOR SETAR, LEBUHRAYA DARUL AMAN, 05100 ALOR SETAR, KEDAH	TEL: 04-734 3420 FAX:04-733 3962

INFORMATION FOR AUTHORS

Submission of a contribution is taken to manifest the fact that the submission has not been submitted, accepted, published, or copyrighted elsewhere.

To avoid publication delays, please send all manuscripts to the Editor and observe the following guidelines.

A) SUBMISSION OF PAPER

Send four (4) copies of your manuscript. Each copy should be complete with illustrations (if any) and an abstract. Submission should be made to the address below :

Chief Editor
The Institution of Engineers, Malaysia
Bangunan Ingenieur,
Lots 60 & 62, Jalan 52/4
Peti Surat 223, Jalan Sultan
46720 Petaling Jaya
Selangor Darul Ehsan
Tel : 03 – 7968 4001 / 7968 4002
Fax : 03 – 7957 7678

Three types of papers are solicited for the IEM Journal:

- (1) **Regular Paper** – Presentation of significant research, developments or applications in any field of engineering or within the scope of the journal. Tutorials and surveys are also considered. For submission, the length should be about 30 pages; double-spacing, single column with font of 12 (Times).
- (2) **Brief Paper** – A concise description of new technical concepts or applications within the scope of the journal. Submission should be about 20 pages; double-spacing, single column with font of 12 (Times).
- (3) **Technical Correspondence** – Letter to the Editor, comments on established engineering topics and discussion of published papers. Submission should be about 10 pages; double-spacing, single column with font of 12 (Times).

NOTE: In the event your paper is accepted for publication, the style of manuscript is in a different format (see point 7 below)

Manuscripts submitted as papers should state the significance of the problem in the Introduction.

Paper size should be of A4 (210 cm x 297 cm) with 2 cm margins on the left, right, and bottom and 3 cm from the top.

Enclose a signed letter giving your preferred address, telephone, fax number, and e-mail address (if available) for correspondence and return of proofs.

If the manuscript has been presented, published, or submitted for publication elsewhere, please also inform the Editor. Our primary objective is to published technical materials not available elsewhere, but on occasion we publish papers of unusual merit that have appear or will appear before other audiences.

The language of the journal is English. However, a papers in Bahasa Melayu are also accept and an abstract in English must be included.

Note that upon acceptance of an article for publication, the author is requested o submit a camera-ready format of the manuscript with single-spacing, double-column and font of 10 (Times). Illustrations and keywords of the papers should be included in the text. An electronic copy of the manuscript should also be submitted together with the hardcopies. The author is also requested to submit a passport-sized and a short biography. This information will be sent to the author by the Editor.

B) STYLE FOR MANUSCRIPT

The manuscript should be typewritten using double-space, using font of 12 (Times); use one side of sheet only and single column format.

The format for IEM Journal follows that of the IEEE Transactions (USA), except that the

submission for you should follow Point 1 above.

As we practice blind review, please do not put your name and address in the manuscript.

Provide and informative 100- to 250- word abstract at the head of the manuscript.

All section should be numbered in Roman such as 1, 11, etc. with the title in capitals.

Sub-sections should be numbered in alphabet such as A, B, C, etc.

Sub-sub-sections (if any) should be numbered as A., A.2, etc.

Number all equations in round brackets such as () and flush to right. The equation should be in the center.

References in the text should be cited each by a reference number in square brackets, e.g. [12] or [4-6], etc.

In the reference section, the references should be written as follows :

Style for papers: Reference Number, Author, first initials followed by last name, title (italics), location and publisher, year, chapter or page numbers, month, and year.

Style for books : Reference Number, Author, first initial followed by last name, title (italics), location and publisher, year, chapter or page numbers (if desired).

Sample format for REFERENCES is as follows :

(for paper)

[3] M. Khalid, S. Omatu, and R. Yusof, "Temperature Regulations with Neural Networks and Alternative Control Shcemes" IEEE Trans on Neural Networks, Vol. 6, No. 3, pp. 572-582, May, 1995.

(for book)

[4] S. Omatu, M. Khalid, and R. Yusof, Neural-Control and Its Applications, London: Springer-Verlag, 1995.

If your paper is in Bahasa Melayu, please provide an abstract in English.

In the event of the paper being accepted, we will require the camera-steady manuscript to be submitted in a double column format, single-spacing and font of 10 (Times). Include all illustrations in between the text (if possible). An electronic copy should be submitted. We prefer word processing to be done in Microsoft Word. If other word processing software is used, please specify.

C) STYLE FOR ILLUSTRATIONS

Try to include the illustrations in between the text.

Originals for illustrations should be sharp, noise-free and of good contrast.

Each illustration must be numbered such as "Figure 1, Figure 2, etc." and have a meaningful caption at the bottom.

For tables, the caption must be at the top.

On graphs, show only the coordinate axes, or at most the major grid lines, to avoid a dense hard-thread result.

All lettering should be large enough to permit legible reduction of the figure to column width, perhaps as much as 4:1. Typing on figures is not acceptable.

Photographs should be glossy prints, of good contrast and gradation and any reasonable size.

Number each original on the back, or at the bottom of the front, and also indicate the author's name.

Upon acceptance of your paper submit a set of the figures and a list of the captions.

ADVERTISING

To advertise in Journal of IEM, please contact Dimension Publishing Sdn. Bhd. Advertisements that appear in Journal of IEM implies neither endorsement nor recommendation by The Institution of Engineers, Malaysia.

SUBSCRIPTIONS

To subscribe Journal of IEM please contact Dimension Publishing Sdn. Bhd. (address below).

Dimension Publishing Sdn. Bhd. (449732-T)
Unit No. 3A-10, Block F, Phileo Damansara 1
9 Jalan 16/11, Off Jalan Damansara
46350 Petaling Jaya, Selangor Darul Ehsan.
Tel: (603) 7955 5335
Fax: (603) 7955 5773
Email: info@dimensionpublishing.com

PUBLICATION DISCLAIMER

The publication has been compiled by IEM and Dimension with great care and they disclaim any duty to investigate any product, process, service, design and the like which may be described in this publication. The appearance of any information in this publication does not necessarily constitute endorsement by IEM and Dimension. They do not guarantee that the information in this publication is free from errors. IEM and Dimension do not necessarily agree with the statement or the opinion expressed in this publication.

COPYRIGHT

Journal of IEM is the official magazine of The Institution of Engineers, Malaysia and is published by Dimension Publishing Sdn. Bhd. The Institution and the Publisher retain the copyright in all material published in the magazine. No part of this magazine may be reproduced and transmitted in any form, or stored in any retrieval system of any nature without the prior written permission of IEM and the Publisher.