



DEPARTMENT OF STATISTICS
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MANIPAL KARNATAKA INDIA 576104.



**International
Workshop and Conference
on
Combinatorial Matrix Theory and
Generalized Inverses of Matrices**

02 - 07 January 2012 10 - 11 January 2012

A Report.

Venue: Innovation Center Building MIT Campus Manipal.

MANIPAL

U N I V E R S I T Y

1 About Workshop and Conference

1.1 Objective of the Conference

Generalized inverses of matrices and combinatorial matrix theory are among areas of matrix theory with a strong theoretical component as well as with applications in diverse areas that have seen rapid advances in recent years. The interaction between graph theory and matrix theory is known to be very fruitful, and example abound where generalized inverses of matrices arising from graphs play an important role. Just to give one example, an expression for the resistance distance between two vertices in a graph in terms of a generalized inverse of the Laplacian matrix is a key tool. The two-day Conference intend to provide an ideal opportunity for participants from India and abroad to interact and exchange ideas in pleasant and academic surroundings.

1.2 Objective of the Workshop

The objective of the workshop is providing a platform for the young generation to have an exposure to lectures from leading mathematicians on the area of Combinatorial Matrix theory and Generalized inverses and its Applications. Apart from tutorial lecture on these topics, the organizers intend to provide exposure to allied linear algebra topics through some special lectures. To meet this objectives several tutorial lectures, special lectures and discussion hours are arranged. An environment for young scholars to interact with leading mathematicians is also created on and off the venue.

1.3 Participation

Having an initial response of 150 individuals (32 Speakers, 56 Students and 63 other participants), the actual attendance for the workshop and conferences were 114 (97 for workshop and 102 for the conference). We have received response from

1. Bangladesh,
2. Canada,
3. Estonia,
4. Finland,
5. Germany,
6. Ireland,
7. Nepal,



Photograph 1: *Pro Vice Chancellor - Dr. Vinod Bhat inaugurating the workshop by lighting the lamp. Accompanying are Professors Steve J Kirkland, K.M. Prasad, N.S.K. Nair and R Balakrishnan*

8. New Zealand,
9. Poland,
10. Portugal,
11. United States of America,
12. PR China and
13. Denmark

apart from India. Most of the speakers who have given their initial consent made their presence possible except two cases where in one case the speaker could not make it because of VISA and other due to financial constraint. The organizing committee was very happy with the response from the speakers for the workshop and conferences.

2 Endorsement and Support

2.1 Societies and National Agencies

The organizers are thankful to INTERNATIONAL LINEAR ALGEBRA SOCIETY(<http://www.ilasic.math.uregina.ca/iic/>) for endorsing these events.



SOCIETY FOR INDUSTRIAL AND APPLIED MATHEMATICS(<http://www.siam.org/>) for being cooperating society.



The organizers place in record their thanks to Professor Steve J Kirkland, the President of ILAS for obtaining the endorsement and agreeing to be the representative of SIAM for these events.

While conducting an international event of this level apart from providing good academic environment and materials, local hospitality of high standard and the local travel facilities are equally important which demand the involvement of very high amount of finance.

Many speakers from abroad and some from organizations like IIT's and ISI have utilized their personal research grant to reach this place and only their local expenses are taken care of by the organizers. Organizers take this opportunity to thank their respective organizations for the support that enabled scientists of high repute meet here and the scholars of the region are benefitted from the formal and informal interaction.

In the interest of providing benefit for students and scientists in the underdeveloped countries of ASIA and help them in developing strong network with the rest of the world, ICTP(International Centre for theoretical Physics) granted a sum of 3000 Euro. They have also permitted the organizers to utilize a part of the amount for a speaker from another country also

THE ABDUS SALAM INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS(<http://www.ictp.it/>) supported us by awarding travel grant for selected speakers.



The speakers nominated for partial support of ICTP travel grant are

1. Prof. Yimin Wie, Fudan University, Shanghai, China.
2. Prof. Md. Maruf Ahmed, BRAC University, Dhaka, Bangladesh.
3. Prof. Oskar Maria Baksalary, Adam Mickiewicz University, Poland.
4. Prof. Om Prakash Niraula, Tribhuvan University, Kathmandu, Nepal.

Unfortunately, Prof. Yimin Wie could not turn up due to a problem with him getting VISA but the other three have utilized the ICTP grant for their travel and local hospitality.



Photograph 2: *Ashma, Pavan, Suma, Nitin, Anitha, Shruti, Shavina, Pallavi, Serah and Banuchitra at Registration Counter*

The following national agencies have supported through the grants which enabled the organizers to have the success in organizing the events:

CENTRAL STATISTICAL OFFICE MINISTRY OF STATISTICS AND PROGRAMME IMPLEMENTATION (<http://www.mospi.nic.in>)



COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (<http://www.csir.res.in>) for supporting us by awarding separate grant-in-aid for workshop and conference.



NATIONAL BOARD FOR HIGHER MATHEMATICS (<http://www.nbhm.dae.gov.in>) for supporting us by awarding grant-in-aid.



2.2 Support from Manipal University

MANIPAL UNIVERSITY is always keen on supporting research related activities. So, the university has provided the maximum possible support to the organizers, apart from regular administrative, secretarial and logistic support. It has provided the maximum possible local transportation to all the delegates and provided accommodation for about 17 speakers at FIVV (normally an accommodation at FIVV costs about INR 6,000 per day for a person) during the workshop and conference. Also, the conference dinner on the day of inauguration of conference is subsidized to the extent of 50 percent. The University has provided the dedicated lecture halls with audio and visual facilities. The support provided by the Manipal University is informally estimated for the cost about INR 10,00,000 (Ten Lakh only).

3 Feedback and the Response

In general, all the participants have expressed their happiness towards

Hospitality

Academic Environment

Facilities available around and

the opportunity they got for the interaction and learning new ideas from leading Mathematicians.

A comment from the participants is that

with an assurance of travel support, many scholars not receiving any funding agencies would have attended and benefited from the program.

With the last comment, organizers find the reason for several dropout but felt helplessness as the response, for our request of fund support, from several agencies till November was not encouraging and could not commit firmly on support for the scholars. Of course, from the organizers end the registration fee is already subsidized to large extent.

4 International Workshop, 02 – 07 January 2012

The workshop was for the duration of 6 days consists of 10 tutorial lectures(21 Hrs.); 6 special lectures (7:30 Hrs.) and formal as well the informal discussion hours on each day. The afternoon session of Saturday (last day) was spent on taking feed back and valedictory session. **Organizers are committed to publish and distribute among all participants at free of cost the lecture notes on selected lectures delivered in the workshop. Editors for the volume are Prof. Bapat Prof. Kirkland Prof. Prasad Prof. Puntanen.**



Photograph 3: Release of Souvenir

Workshop was inaugurated by Pro Vice Chancellor - Dr. H. Vinod Bhat. Prof. Steve Kirkland and Prof. R. Balakrishnan were the guests of honor for the function. Souvenir of the workshop was released by Prof. Kirkland.

The actual conduct of the workshop is as given in the following schedule:

Venue: NLH 103, New Lecture Hall Complex, MIT

		Time Duration								
		9.00-10.00	10.00-11.15	11.15-11.45	11.45-12.45	12.45-14.00	14.00-15.00	15.00-15.30	15.30-16.30	16.30-17.30
Date	02-01-2012	Breakfast & Registration	SPL 1 (SSK)	Tea	TL 1 (RBK)	Lunch Break	TL 2 (SP)	Tea	TL 3(RBK)	Discussion

- 02-01-2012; 18.00 Inaugural Function Dinner at 20.00 ; Venue: AC Seminar Hall

		Time Duration								
		9:00-10:00		10:30-11:30	11:30-12:45		14:00-15:00		15:30-16:30	16:30-17:30
Date	03-01-2012	TL 4(OMB)	10:00-10:30 Tea Break	TL 5 (OMB)	SPL 2 (TESR)	12:45-14:00 Lunch Break	TL 6 (SRK)	15:00-15:30 Tea Break	TL 7 (SRK)	Problems & Discussion
	04-01-2012	TL 8 (SP)		TL 9 (SP)	SPL 3(SG)		TL 10 (GT)		TL 11 (GT)	
	05-01-2012	TL 12 (HJW)		TL 13 (HJW)	TL 14 (TESR)		TL 15 (TESR)		Break	
	06-01-2012	TL 16 (JJH)		TL 17 (JJH)	SPL 5 (KMP)		TL 18 (SSK)		TL 19 (SSK)	
	07-01-2012	TL 20 (SIMO)		TL 21 (SIMO)	SPL 6 (RB)		FB		Valedictory	

The titles of lectures are as given below:

SSK - Steve J Kirkland - Graph Structure Revealed by Spectral Graph Theoretic Methods

SSK - Steve J Kirkland - A Structured Condition Number for an Entry in the Stationary Distribution of a Markov Chain

SRK - Sivaramakrishnan - Applications of the Laplacian Matrix of Graphs

SP - Sukanta Pati - Matrices and Graphs

SP - Sukanta Pati - Algebraic Connectivity of Graphs

OMB - Baksalary O.M. - Hyderabad 2000 - Manipal 2012 – over 11 years with projectors

TESR - TES Raghavan - Graph theoretic applications to computing the nucleolus of an assignment game

RBK - R Balakrishnan - Spectral Properties of Graphs

GT - Trenkler Götz - Projectors in the Linear Regression Model

HJW- Hans Joachim Werner - G-Inverses, Projectors, and the General Gauss-Markov Model

JJH - Je rey Joseph Hunter - The derivation of Markov Chain Properties using Generalized Matrix Inverses

SIMO - Simo Puntanen - Matrix Trix for Statistical Model

KMP - K. Manjunatha Prasad - What are “generalized inverses” any way?

RB - Rajendra Bhatia - Matrix Inequalities

SG- S Ganesan : Covariance Matrices in Nuclear Data

GPHS - Styán G.P.H. - An Introduction to Yantra Magic Squares and Agrippa-type Magic Matrices

Scheduled on Thursday, January 5, 2012; Time: 7:00 - 8:00 pm; Video Lecture and discussion through SKYPE.



Photograph 4: *Prof. Sukanta Pati (on the left) of IIT Guwahati delivering his lecture on ‘Algebraic Connectivity’ and Prof. Oskar M Baksalary (on the right) of Adam Mickiewicz University, on his journey with ‘Projectors’ for past 11 years.*

Apart from above academic activities, an informal arrangement of visiting the places around and cultural activities have been arranged for the delegates. The activities were as follows:

02-01-2012 Evening : Bharatha Natya (Indian Classical Dance) programme by Shridhara Rao Bannanje’s troupe, following the inaugural function

03-01-2012 Evening : Around University, Anatomy Museum & End Point visit

04-01-2012 Evening : Malpe Beach & Krishna Temple visit

05-01-2012 Evening : Photo Session; Barkur Palace visit



Photograph 5: *‘Finland’ meet ‘New Zealand’ in India - Prof. Simo Puntanen with Prof. Jeffrey Hunter*

08-01-2012 St. Mary Island Picnic (during the break between workshop and conference).

The workshop part was concluded with feed back session and valedictory function. Registrar of Manipal University, Dr. G.K. Prabhu was the chairman of the valedictory function and Prof. Rajendra Bhatia and Prof. Götz Trenkler were the chief guests of the function. Participation certificates for participants and the thanking letters for the resource persons were distributed on this occasion.



Photograph 6: Dr. H. Vinod Bhat - Pro Vice Chancellor lighting the lamp (on the left). Others accompanying are Prof. Krikland, Prof. Prasad, Prof. Nair and Prof. Balakrishnan. On the right - Prof. Raghavan of University of Illinois at Chikago being greeted by Prof. Sudhakara.



Photograph 7: (on the left) Dr. H Vinod Bhat - Pro Vice Chancellor addressing the gathering at Inaugural function; (on the right) Shridhara Rao Bannanje and his team performing "Bhaarthya Natyam"

5 International Conference

Two days conference starting on 10th January was with FOUR plenary sessions, 18 invited talks and 12 contributed talks. Invited talks and contributed talks were arranged in three parallel sessions. Plenary talks were arranged in PROF. S.S. SHRIKANDE HALL and three parallel sessions were arranged in PROF. R.A. BRUALDI HALL, PROF. M.P. DRAZIN HALL and PROF. ADI-BEN ISRAEL HALL respectively. **Organizers have arranged for an agreement with SPRINGER in publishing the proceedings of the conference with an editorial board comprising Prof. Bapat Prof. Kirkland Prof. Prasad and Prof. Puntanen.**

The initial list of speakers (invited and contributed) was as given below:
List of invited speakers presented papers in the conference:

1. RAFIKUL ALAM, *Indian Institute of Technology, Guwahati*
2. OSKAR MARIA BAKSALARY, *Adam Mickiewicz University, Poland*
3. R. BALAKRISHNAN, *Bharathidasan University, Tiruchirapalli*
4. RAJENDRA BHATIA, *Indian Statistical Institute, New Delhi*
5. FRANCISCO CARVALHO, *Polytechnic Institute of Tomar, Portugal*
6. JEFFREY JOSEPH HUNTER, *Auckland University of Technology, New Zealand*
7. SURENDER KUMAR JAIN, *Ohio University, USA*
8. STEVE J KIRKLAND, *Hamilton Institute, Ireland*
9. TÕNU KOLLO, *University of Tartu, Estonia*
10. BHASKARA RAO KOPPARTY, *Indiana State University, USA*
11. S.H. KULKARNI, *Indian Institute of Technology, Madras*
12. AUGUSTYN MARKIEWICZ, *Poznan University of Life Sciences, Poland*
13. A. R. MEENAKSHI, *Annamalai University, Chennai*
14. SIMO PUNTANEN, *University of Tampere, Finland*
15. TES RAGHAVAN, *University of Illinois at Chicago, USA*
16. SHARAD S SANE, *Indian Institute of Technology, Bombay*
17. K.C. SIVAKUMAR, *Indian Institute of Technology, Madras*
18. SIVARAMAKRISHNAN SIVASUBRAMANIAN, *Indian Institute of Technology, Bombay.*
19. MURALI SRINIVASAN, *Indian Institute of Technology, Bombay*

20. GEORGE PH STYAN, *McGill University, Canada.*
21. GÖTZ TRENKLER, *Technische Universität Dortmund, Germany*
22. HANS JOACHIM WERNER, *University of Bonn, Germany*

List of speakers presented contributed paper in the conference:

1. MOHAMMAD MARUF AHMED, *BRAC University, Dhaka*
2. A. ANURADHA, *Bharathidasan University, Tiruchirapalli*
3. RAVI SHANKAR BHAT, *Manipal Institute of Technology, Manipal*
4. SACHINDRANATH JAYARAMAN, *Indian Institute of Science Education and Research, Kolkata*
5. DEBAJIT KALITA, *Indian Institute of Technology, Guwahati*
6. K. KAMARAJ, *University College of Engineering, Arni*
7. KUNCHAM SYAM PRASAD, *Manipal Institute of Technology, Manipal*
8. K. SHREEDHAR, *K. V. G College of Engineering, Sullia.*
9. KEDUKODI BABUSHRI SRINIVAS, *Manipal Institute of Technology, Manipal*
10. G. SUDHAKARA, *Manipal Institute of Technology, Manipal*
11. H. S. SUJATHA, *Manipal Institute of Technology, Manipal*



Photograph 8: *Halls for plenary Sessions and parallel sessions are named after pioneers in the area of “Combinatorial Matrix Theory”, “Generalized Inverse of Matrices” and “Matrix Methods”. Apology for not able to obtain the photograph of M.P. Drazin in time.*

6 Conference Schedule and Activities

Venue: V Floor Innovation Center

10th January 2012

9:00 - 9:30 Registration

9:30 - 10:20 Plenary Session

Prof. S.S. Srikhande Hall



Steve J Kirkland, Hamilton Institute, Ireland - SIAM Representative

The Group Inverse and Conditioning of Stationary Vectors for Stochastic Matrices

Chairman: Prof. R.B. Bapat

10:20 - 11:00 Tea Break

Invited Talks:

Prof. R.A. Brualdi Hall

11:00 - 11:35

Sivaramakrishnan Sivasubramanian, Indian Institute of Technology, Bombay

The second Immanant of two Combinatorial Matrices

11:40 - 12:15

T.E.S. Raghavan, University of Illinois at Chicago, USA

Optimization Methods in Matrices

12:20 - 12:55

A. R. Meenakshi, Professor Emeritus, Annamalai University, Annamalai Nagar.

Regular Matrices over an Incline



Photograph 9: *Prof. Sivaramakrishnan Sivasubramanian of Indian Institute of Technology, Bombay*

Chairman: Prof. R. Balakrishnan

Invited Talks: Prof. M. P. Drazin Hall

11:00 - 11:35

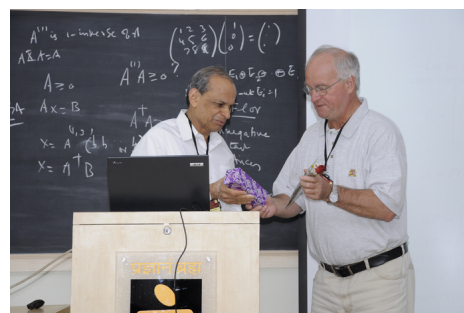
Surender Kumar Jain, Ohio University, USA
Some Results on Semiring (Semigroup) of Nonnegative Matrices

11:40 - 12:15

Oskar Maria Baksalary, Adam Mickiewicz University, Poland
On Subspaces attributed to Functions of Oblique Projectors

12:20 - 12:55

K.C. Sivakumar, Indian Institute of Technology, Madras
Weak Monotonicity of Interval Matrices



Photograph 10: Chair of the session - Prof. Trenkler honoring the speaker Prof. S.K. Jain

Chairman: Prof. Götz trenkler

Invited Talks: Prof. Adi Ben-Israel Hall

11:00 - 11:35



Je rey Joseph Hunter, Auckland University of Technology, New Zealand.
The Role of Kemeny's Constant in Properties of Markov Chains

11:40 - 12:15

Hans Joachim Werner, University of Bonn, Germany
Weak Complementarity, Non-Testability and Restricted Moore-Penrose Inverses

Photograph 11: Prof. Rao honoring the speaker Prof. Carvalho

12:20 - 12:55

Francisco Carvalho, Polytechnic Institute of Tomar, Portugal
Models with Commutative Orthogonal Block Structure: Inference and Structured Families

Chairman: Prof. K.P.S. Bhaskara Rao

13:00 - 14:30

Lunch

14:30 - 15:20 Plenary Session

Prof. S.S. Srikhande Hall

Rajendra Bhatia, Indian Statistical Institute, New Delhi
The Sylvester Equation

Chairman: Prof. Simo Puntanen

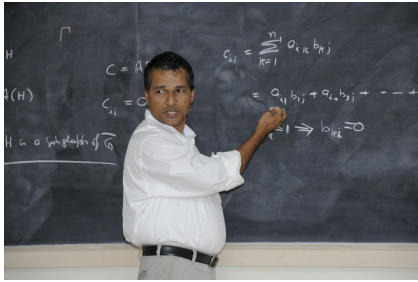
15:20 - 16:00

Tea Break

Contributed Talks:

Prof. R.A. Brualdi Hall

16:00 - 16:20



G. Sudhakara, Manipal Institute of Technology, Manipal
Realization of Product of Adjacency Matrices of Graphs

16:20 - 16:40

A. Anuradha, Bharathidasan University, Tiruchirapalli.
Nonisomorphic Cospectral Oriented Hypercubes

Photograph 12: *Prof. Sudhakara G*
delivering his talk.

Chairman: Prof. Sivaramakrishnan

Contributed talks:

Prof. M. P. Drazin Hall

16:00 - 16:20

Sachindranath Jayaraman, IISER, Thiruvanthapuram
Matrix Partial Orders in Indefinite Inner Product Spaces

16:20 - 16:40

Mohammad Maruf Ahmed, BRAC University, Dhaka
Assorted Representations of Generalized Inverse with Numerical Solutions



Chairman: Prof. Augustyn Markiewicz

Photograph 13: *Prof. M. Maruf Ahmed* of BRAC University, Dhaka

Contributed Talks: Prof. Adi Ben-Israel Hall

16:00 - 16:20

Kuncham Syam Prasad, Manipal Institute of Technology, Manipal.

Insertion of factors property in Matrix Nearings

16:20 - 16:40

*Surekha**, Manipal Institute of Technology, Manipal.

Relationship between Block Domination Parameters of Graphs

Chairperson: Prof. A.R. Meenakshi

* Absent



Photograph 14: *Prof. AR Meenakshi chairing the session*

16:45 - 17:00 Photo Session

17:00 - 20:00 Inaugural Function Chaitya Hall, FIVV

Inaugural Function of Conference

Inaugural function of the conference was started with a Video recorded talk by *Prof. G.P.H. Styran* from McGill University, Canada and discussion with him over the SKYPE. Dr. H.S. Ballal - Pro Chancellor inaugurated the conference. Prof. K.P.S. Bhaskara Rao of Indiana University, USA, Prof. Simo Puntanen of University of Tampere, Finland and Prof. TES Raghavan of University of Illinois at Chicago were the chief guests. Prof. Ravindra Bapat of ISI Delhi who is the Chairman of Scientific committee, also presided over the function.

Inaugural function was followed by semi classical dance by M.Sc. - Biostatistics student, folk dance by kids Sushumna and Akshatha, and classical music by Ravikiran and his troupe.



Photograph 15: *Kids - Akshatha and Sushumna*



Photograph 16: Dr. H.S. Ballal (on the left) lighting the lamp at Inaugural function of the conference. Others in the picture are Prof. K.M. Prasad; Prof. Simo Puntanen; Prof. KPS Bhaskara Rao; Prof. TES Raghavan; Prof. R.B. Bapat and Prof. NSK Nair. Prof. GPH Styan (on the right) talking over the SKYPE

Conference Schedule contd..

Venue: V Floor Innovation Center

11th January 2012

9:30 - 10:20 Plenary Session

Prof. S.S. Srikhande Hall

Bhaskara Rao Kopparty, Indiana State University,
USA

Sums of Idempotent Matrices

Chairman: Prof. S.K. Jain



Photograph 17: Prof. KPS Bhaskara Rao being greeted by the Chair - Prof. SK Jain

10:20 - 11:00 Tea Break

Invited Talks: Prof. R.A. Brualdi Hall

11:00 - 11:35



Photograph 18: *Prof. Sharad S Sane with Chair of the session Prof. Steve Kirkland*

R. Balakrishnan, Bharathidasan University, Tiruchirapalli
Polynomial Time Computation of the Hosoya Index of Some Families of Graphs

11:40 - 12:15

Sharad S Sane, Indian Institute of Technology, Bombay
Linear Algebra of Strongly Regular Graphs and related objects

12:20 - 12:55

Murali Srinivasan, Indian Institute of Technology, Bombay
The Complexity of the q-analog of the n-cube

Chairman: Prof. Steve J Kirkland

Invited Talks: Prof. M.P. Drazin Hall

11:00 - 11:35

Rafikul Alam, Indian Institute of Technology Guwahati
On Structured Mapping Problems for Matrices

11:40 - 12:15

S.H. Kulkarni, Indian Institute of Technology, Madras
Generalized Inverses and Approximation Numbers

12:20 - 12:55

*Yimin Wei**, Fudan University, China
Condition Numbers for Moore-Penrose Inverse, Linear Least Squares, Total Least Squares, Matrix Equations and Tikhonov Regularization



Photograph 19: *Prof. Rafikul Alam delivering his talk*

Chairman: Sivakumar

* Absent

Invited Talks: Prof. Adi Ben-Israel Hall



Photograph 20: *Prof. Tonu Kollo receiving memento from Prof. Baksalary after his talk*

11:00 - 11:35

Simo Puntanen, University of Tampere, Finland.
Equalities of the BLUEs and/or BLUPs in two Linear Models

11:40 - 12:15

Augustyn Markiewicz, Poznan University of Life Sciences, Poland
An Optimality of Neighbour Designs Under Interference Models

12:20 - 12:55

Tonu Kollo, University of Tartu, Estonia
Matrix Problems of Skewed Multivariate Distributions

Chairman: Oskar M Baksalary

13:00 - 14:30 Lunch

14:30 - 15:20 Plenary Session Prof. S.S. Srihande Hall

Gotz Trenkler, Technische Universitat Dortmund, Germany
Functions of Orthogonal Projectors Involving the Moore-Penrose Inverse

Chairman: J.J. Hunter



Photograph 21: *Prof. Trenkler receiving memento from Prof. Hunter.*

Contributed Talks: Prof. R.A. Brualdi Hall



Photograph 22: Prof. Murali Srinivasan

15:30 - 15:50

Debajit Kalita, Indian Institute of Technology, Guwahati.
The Singularity of Weighted Directed Graphs

15:50 - 16:10

K. Shreedhar, K. V. G College of Engineering, Sullia
Metric Dimension of Graphs by Using Distance Matrices

Chairman: Prof. Murali Srinivasan

Contributed Talks: Prof. M. P. Drazin Hall

15:30 - 15:50

K. Kamaraj, University College of Engineering, Arni
Characterization of Normal Matrices in an Indefinite Inner Product Spaces

15:50 - 16:10

Kedukodi Babushri Srinivas, Manipal Institute of Technology, Manipal
Matrices associated with $GI(N)$



Photograph 23: Prof. Hans J Werner

Chairman: Prof. H.J. Werner

Contributed Talks: Prof. Adi Ben-Israel Hall



Photograph 24: Prof. Sreemathi S Mayya

15:30 - 15:50

Ravi Shankar Bhat, Manipal Institute of Technology, Manipal
Strong/Weak Edge Vertex Mixed Domination Number of a Graph

15:50 - 16:10

H.S. Sujatha, Manipal Institute of Technology, Manipal.
Realization of Modulo 2 Product of Adjacency Matrices of Graphs

Chairperson: Prof. Sreemathi S Mayya

16:10 - 16:30 Tea Break

16:30 Valedictory Function : AC Seminar Hall

The valedictory function for the conference was chaired by Vice Chancellor - Dr. K. Ramnarayan and the chief guests on the occasion were Prof. SK Jain, Prof. Jeremy Hunter, Prof. HJ Werner and Prof. Kumkum Garg. Prof. R.B. Bapat, the chairman of Scientific committee and Prof. NSK Nair were also presided over the function. Prof. Sane from IITB, Prof. Om Prakash from Thribhuvan University Nepal and Prof. Kirkland, President of ILAS are prominent among individuals giving feedback on conference. There was overwhelming appreciation on the conduct of conference which gave an opportunity for Mathematicians from several countries to meet and discuss in a wonderful academic and beautiful environment. Everyone appreciated on the academic reward benefited through the conference. Prof. Bapat announced on publication of lecture notes on selected workshop lectures which is to be published by Manipal University Press and proceedings of the conference published by the Springer.



Photograph 25: Dr. K. Ramnarayan, the Vice Chancellor of Manipal University addressing the gathering. On the stage (from the left) are Prof. Jain, Prof. Hunter, Prof. Werner, Prof. Bapat, Prof. Kumkum Garg and Prof. NSK Nair.

7 Selected Photographs from the Events



Photograph 26: From NW corner to the right - a. Prof. Kirkland inspiring through his dedicated involvement throughout the workshop and conference and interactions with participants; b. Duo Prof. Trenkler and Prof. Baksalary absorbing every moments of the workshop and conference; c. Prof. Balakrishnan with a rose before his lecture; d. Enjoying(!) food at Food Court; e. Artists performing 'Bharatha Natyam'; f. Prof. Werner teaching g -inverses in Gauss-Markov linear models



Photograph 27: a. Bharatha Natyam performance; b. and c. M.Sc. Biostatistics students; d. Ravi Kiran and his team at performance of classical music; e. Prof. Puntanen addressing the gathering in conference inauguration.

8 Name Address

The following is the list of speakers, students and participants who have expressed their intention, initially, to participate in the workshop and conference. The last column indicate the category (Speaker /student /other participant), where as the just previous to that column indicating if the individual actually attended or not. The actual attendance for the workshop and conferences were 114 (97 for workshop and 102 for the conference).

No	Name	email	WS	Conf	Atnd	Category
1	Prof. Oskar M Baksalary	baxx@amu.edu.pl	Yes	Yes	Yes	Speaker
2	Prof. R. Balakrishnan	mathbala@sify.com	Yes	No	Yes	Speaker
3	Prof. Rajendra Bhatia	rbh@isid.ac.in	Yes	Yes	Yes	Speaker
4	Prof. Je rey Joseph Hunter	je_reyjhunter@gmail.com	Yes	Yes	Yes	Speaker
5	Prof. Charles R. Johnson	crjohnso@math.wm.edu	Yes	Yes	No	Speaker
6	Prof. Steve J. Kirkland	stephen.kirkland@nuim.ie	Yes	Yes	Yes	Speaker
7	Prof. Bhaskara Rao K	bkopparty@isugw.indstate.edu	Yes	Yes	Yes	Speaker
8	Prof. Simo Puntanen	simo.puntanen@uta.fi	Yes	Yes	Yes	Speaker
9	Prof. Sivaramakrishnan	krishnan@math.iitb.ac.in	Yes	Yes	Yes	Speaker
10	Prof. George P.H. Styan	styan@math.mcgill.ca	Yes	Yes	Yes	Speaker
11	Prof. Trenkler Götzt	trenkler@statistik.uni-dortmund.de	Yes	Yes	Yes	Speaker
12	Prof. Yimin Wei	ymwei@fudan.edu.cn	Yes	Yes	No	Speaker
13	Prof. Hans J Werner	hjlw.de@uni-bonn.de	Yes	Yes	Yes	Speaker
14	Prof. Sukanta Pati	pati@iitg.ernet.in	Yes	No	Yes	Speaker
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Photograph 28: *WORKSHOP GROUP PHOTO - Sitting from left: Steve Kirkland, Francisco Carvalho, J J Hunter, TES Raghavan, H J Werner, OM Baksalary, NSK Nair, K M Prasad, Sudhakara, Shreemathi Mayya Standing 1st row: Nitin , Pavan, Amitha, serah, Shavina, Vinitha, Divya, Reema, Pallavi, Sri Raksha, Melissa, Apporva Hegde, Apoorva, Vikas, Manjunath, Santhi, Banuchitra Standing 2nd row: Biswajit Deb, Shahistha, Shruti, Ashma, Indulal G, Milan Nath, Debajit Kalita, Sam Johnson, Bhargavarama Sarma, Maruf Ahmed, Kamaraj, Syed Asifulla, Manjunath, Madgala Werner Standing 3rd row: Chaitra, Hamsa Nayak, Vasumathi, Anitha, Divya, Subramaniam, Somasundaram, Kalyan Sinha, Chaluvaraju, Vibekananda Dutta, Richard Werner, Narendra Shrimali, Mrs. Baksalary, Mrs. Carvalho Standing 4th row: Ashwini, Suma, Shruthi Rao, Nivedita Baliga, Sowmya, Sujatha, Indira, Anuradha, Anuvarghese, Jais Kurian, Sanjay Kumar Patel, Vasudeva G Standing last row: Vinay, Devadas Nayak, Mohan, Kiran Hande, Binu VS, Ramu G, Balaji, Sukumar D, Ventakaramana, Vasanth, Mohandas*



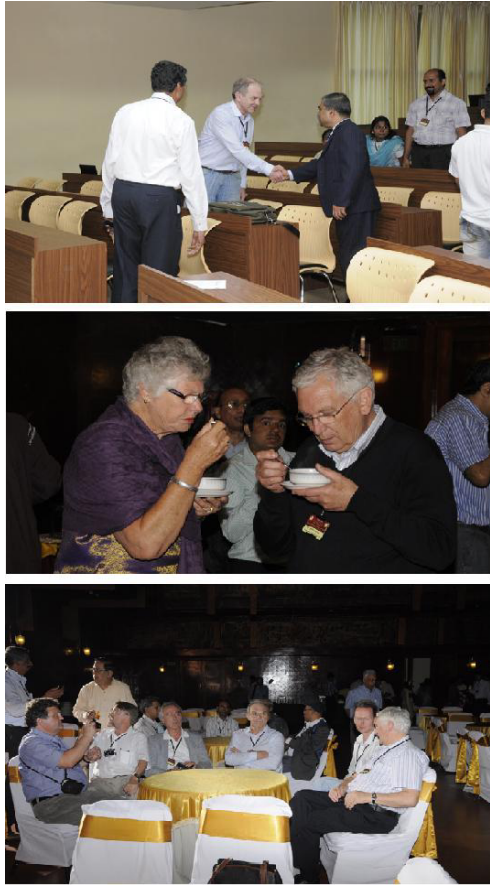
Photograph 29: *a. Prof. Sivakumar with Prof. Trenkler, b. Prof. Puntanen, c. Prof. Jain received by Prof. Prasad, Standing behind is Prof. Ashma d. Prof. Bhatia being greeted by Prof. Puntanen.*



Photograph 30: *CONFERENCE GROUP PHOTO -1st row: R.B Bapat, Sachindranath Jayaram, Simo Puntanen, J J Hunter, H J Werner, Steve Kirkland, SK Jain, K Manjunatha Prasad, K P S Bhaskara Rao, Om Prakash Niraula, G Trenkler, R Balakrishnan, Augustyn Markiewicz, N Sreekumaran Nair 2nd row: Ramu G, Balaji, O M Baksalary, Francisco Carvalho, Tonu Kollo, Ashma, Vasumathi, Adelaide Rose Meryl, Anuvarghese, Anuradha, A R Meenakshi 3rd row: D Sukumar, Sam Johnson, SH Kulkarni, Rafikul Alam, Shreedar Kunikullayya, Sudhakara, A Raghavendra, Jais Kurian 4th row: Binu Kumar, Debajit Kalita, Mohan, Binu VS, , Maruf Ahmed, Sivaramakrishnan, Anjan Ray Chaudhury, Kamaraj Last row: Biswajit Deb, K C Sivakumar, Sharad S Sane, Rajendra Bhatia, Murali K Srinivasan*



Photograph 31: *a. Student Volunteers, b. Student participants, c. Dr. GK. Prabhu addressing the gathering at workshop valedictory function.*



Photograph 32: a. Dr. GK Prabhu, the Registrar greeting Prof. Tonu Kollo b. Dr. Prabhu with Prof. Bhatia, c. Hunter couple with their soup, d. Prof. Bhaskara Rao being greeted by Pro chancellor, e. Markiwicz, Puntanen, Werner, Kollo, Steve and Hunter on chat and Bapat, Rafikul and Om Prakash are seen from the behind f. Organizers receiving an applause from the participants and delegates