

International Forum for Mathematical Modeling 2014

DAAD Partnership program

10th-21st March 2014

Organized by

Research & Development Center for Mathematical Modeling

Department of Mathematics
University of Colombo



DAAD



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Title	INTERNATIONAL FORUM FOR MATHEMATICAL MODELING
Theme	Mathematical Modeling for the Advancement of Interdisciplinary Sciences
Chair Person	Dr. S.S.N. Perera (Senior Lecturer- Department of Mathematics, University of Colombo)
Secretaries	MS. S.D. Perera Ms. G.N. Karunathunge
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1. Introduction

Under the German Academic Exchange Program (DAAD) a partnership program has been established between the University of Kaiserslautern (TUKL), Germany and the following institutions:

- Institute of Technology Bandung (ITB), Indonesia
- Kathmandu University (KU), Nepal
- University of Colombo (UOC), Sri Lanka

The principal goal of this network is to strengthen mathematics education in Mathematical Modeling, Stochastic tools, Numerical Methods and Financial Mathematics, and to organize DAAD network meetings, conferences, workshops and training programs which would strengthen the relationship between the above mentioned universities. The long-term goal is to standardize and homogenize the teaching curricular in the above universities which allows for a smooth transition of qualified students admitted into Master and Doctoral degree programs.

Several workshops and training programs have been organized by the above mentioned universities, with the first one being held in Indonesia from 8th April to 19th April, 2013 at the Institute of Technology Bandung. One faculty member and three Ph.D. students representing the Department of Mathematics, University of Colombo, participated in this workshop. The Second workshop was held from 1st September, 2013 to 13th September, 2013 at Kathmandu University (KU), Nepal. Three Ph.D. students and one faculty member representing UOC participated in this event and presented their current research on both occasions. The feedback they received was very helpful and encouraging. They were also able to share knowledge and gain experience related to their research.

Under the guidance and support of the DAAD, the International Forum for Mathematical Modeling organized by the Research and Development Center for Mathematical Modeling, Department of Mathematics, University of Colombo was held from 10th March, 2014 to 24th March 2014 under the theme of Mathematical Modeling for the Advancement of Interdisciplinary Sciences. The Forum consisted of two compact courses, two day international conference, a modeling week, a mini-conference on Mathematical Modeling and Systems Approaches in Urban Health and Dengue, four workshops on different themes organized in collaboration with industry professionals and a series of invited talks by international academia. The whole program concluded

successfully attracting more than 300 local and international participants and more than 60 local and international resource persons from industry and academics. Without financial aid from DAAD, none of the activities would have been possible.

2. Partners

Under the German Academic Exchange Program (DAAD), the following institutions collaborated in this forum.

- i) University of Kaiserslautern, Germany (TUKL)
- ii) Kathmandu University, Nepal (KU)
- iii) Institute of Technology Bandung, Indonesia (ITB)
- iv) University of Colombo, Sri Lanka (UOC)

In addition, University Grants Commission (UGC) and Higher Education for Twenty-first Century (HETC) project in Sri Lanka collaborated for this event.

International participants funded by DAAD included

- TUKL- Dr. Oliver Tse, Dr. Torben Fattler
- KU- Dr. Dil Gurung, Ms. S. Acharya, Mr. M. Gokul, Mr. Hem Raj Pandey
- ITB- Dr. Sapto Wahtyu Indratno, Ms. Ayu Shabrina, Ms. Isti Rodiah, Mr. Dipo Aldila

All airfare and other expenses were borne by DAAD, only local hospitality which included food, lodging and transport was provided by University of Colombo.

3. Collaborators

- University Grant Commission, Sri Lanka (UGC)
- Higher Education for Twenty First Century Project (HETC)
- Actuarial Association of Sri Lanka
- Association of Financial Analysis Sri Lanka

4. Objectives

Enhance the use of mathematical modeling among young researchers and postgraduate students as a tool for research, and develop interdisciplinary collaboration between local and foreign researchers.

5. Foreign Resource Persons

In addition to partner universities, the following resource persons from various countries attended the forum.

University	Number of Resource Persons
Center for Computational Continuum Mechanics (C ³ M), University of Ljubljana, Slovenia	Dr. Aleksander Gram
Institute of Technology Bandung, Indonesia (ITB)	Prof. Dr. Edy Soewono
Institute of Technology Bandung, Indonesia (ITB)	Dr. Yudi Soeharyadi,
Elon University, Elon, North Carolina, USA	Dr. Crista Arangala
Loyola College, Chennai, Tamil Nadu	Dr. P. Antony Kishore
Bharathiar University, Coimbatore-46,Tamilnadu	Dr. S. Narayanamoorthy
North Maharashtra University, Jalgaon, India	Dr. R. L. Shinde
National Institute of TechnolohuRourkela,Rourkela, Odisha	Dr. Snehashish Chakraverty Mr. Diptiranjana Behera Ms.Smita Tapaswini
Nanyang Technological University, Nanyang Link, Singapore	Dr. Nicolas Privault
United Nations University, Malaysia	Dr. Jose Siri
Federal University Oye-Ekiti, Ekiti State, Nigeria.	Mr.Bakare Emmanuel Afolabi

Airfares for above participants were borne by their respective home institutions or by themselves while local hospitality which included food, lodging and transport were provided by University of Colombo.

6. Agenda and Activities

6.1 International Conference on Mathematical Modeling

International Conference on Mathematical Modeling was held on 13th and 14th, March 2014 at Department of Mathematics, University of Colombo as a part of the International forum for Mathematical Modeling.

The inauguration ceremony of the conference was held on 13th March 2014, at Department of Mathematics, University of Colombo. Mr. Ajith Nivard Cabraal, Governor, Central Bank of Sri Lanka was the Chief Guest, at this conference. Professor S.S.M.K. Kshanika Hirimburegama, Chairperson, University Grants Commission, Dr. W.K. Hirimburegama, Vice Chancellor University of Colombo, Professor L.L. Ratnayake, Project Director, HETC were some of the distinguished speakers at this event. A target audience comprised of local and foreign senior academia, regulators, business leaders and promoters, CEO's, finance industry professionals and students.

The Technical sessions were held on 14th, March 2014 at the Department of Mathematics, University of Colombo. There was a tremendous response to 'call for papers' from local/international researches. More than 46 full papers were submitted from countries Sri Lanka, India, Nepal, Indonesia, Bangladesh, Nigeria and USA out of which 33 papers were accepted. All accepted papers were published in the conference proceedings. There were many interesting presentations on Mathematical Modeling and it provided a great intellectual and social interaction for the participants.

There were six sessions that were chaired by local and foreign academia.

Session 1A: PDE Modeling chaired by Prof. T. R. Ariyaratne- Former Dean,
- Faculty of Science, University of Colombo

Session 1B: Mathematical Modeling in Pathology & Epidemiology chaired by
- Prof. Saroj Jayasinghe- Head Clinical Medicine, University of Colombo & Prof.U.J. Sonnadara- Senior Professor, Physics, University of Colombo

Session 2A: Fuzzy Models chaired by Prof. J. K. D. S. Jayaneththi, Professor-
- Physics, University of Colombo

Session 2B:- Statistical Modeling chaired by Dr. Chandani Nawarathne,
Department of Mathematics and Computer Science, The Open University of Sri Lanka.

Session 3: - Mathematical Modeling with Optimization chaired by Dr. Torben Fattler, University of Kaiserslautern (TUKL), Germany

Session 4: - Mathematical Modeling in Finance chaired by Ms. Manohari Gunawardena, Senior Vice President, DFCC Bank.



In addition, there were series of invited talks.

Name	Affiliation	Title of the Talk
Dr. R. L. Shinde	Department of Actuarial Science, Director, School of Mathematical Sciences, North Maharashtra University Jalgaon, India	Stochastic Mortality Modeling and Forecasting for Indian Population with Applications in Actuarial Science
Dr. Oliver Tse	University of Kaiserslautern, Germany	From Microscopic to Macroscopic
Dr. P. Antony Kishore	Assistant Professor of Mathematics Loyola College Chennai, Tamilnadu, India	Cayley Graphs and Network Modeling
Dr. Sneathish Chakraverty	National Institute of Technology Rourkela, Rourkela, India	Non Probabilistic Uncertainty Analysis of Imprecisely Defined Systems
Dr. Christa Arangala	Elon University, Elon, NC	Pandora, Sports Ranking, Google Page Rank and Other Practical Applications of Linear Algebra
Dr. Torben Fattler	University of Kaiserslautern, Germany	A Dynamical Wetting Model: Construction and Analysis Via Dirichlet Forms
Dr. Dil B. Gurung	Department of Natural Sciences (Mathematics), Kathmandu University, Nepal	Models on Bio-Heat Transfer Equations in Living Tissues and Some Applications
Dr. S. Narayanamoorthy	Bharathiar University, Coimbatore, Tamilnadu, India	Fuzzy mathematical models and its applications

6.2 Compact Courses

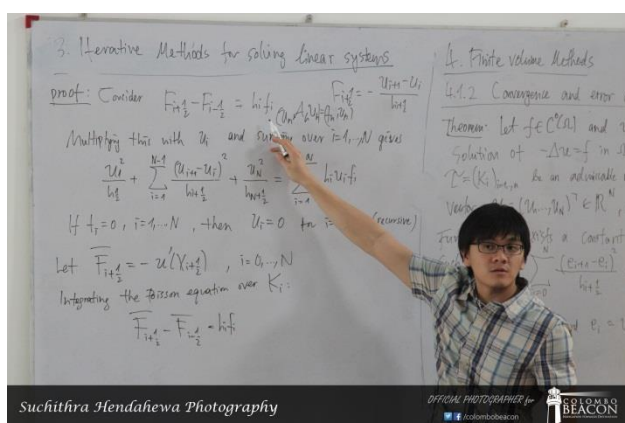
Two short courses of duration 20 hours each were offered by the faculty at TUKL. The main objective of these short courses was to deliver a focused knowledge to students who are reading for an M. Phil. /Ph. D. in Mathematical Modeling and are interested in pursuing a career related to mathematical modeling, as well as for young academia who are interested in the following topics.

6.2.1 Compact Course on Numerical Method in Elliptic and Parabolic Equations

Compact Course on Numerical Method in Elliptic and Parabolic Equations was held from 10th to 13th March, 2014 at the Department of Mathematics, University of Colombo as a part of the International forum for Mathematical Modeling. Dr. Oliver Tse, Department of Mathematics, University of Kaiserslautern, Germany, conducted this course. 40 participants attended this workshop out of which 11 persons from foreign universities, 10 local participants from other universities in Sri Lanka and the rest from University of Colombo.

6.2.2 Compact Course on Stochastic Modeling

Compact Course on Stochastic Modeling was held from 17th to 20th March, 2014 at the Department of Mathematics, University of Colombo. Dr. Torben Fattler, Department of Mathematics, University of Kaiserslautern, Germany, conducted this compact course. 40 participants attended this workshop.



6.3 Workshops

There were four workshops organized in parallel to the International forum on different themes organized in collaboration with industry professionals on below topics.



6.3.1 Workshop on Introduction to Water Resources Modeling

Workshop on Introduction to Water Resources Modeling was held on 13th March, 2014 from 8.00 am to 1.00 pm at the Department of Mathematics, University of Colombo. Professor D. A. Thanthrigoda, chairman of NASTEC and Senior Professor of Physics, Department of Physics, University of Sri Jayewardenepura, chaired the workshop. 40 participants attended this workshop out of which 8 were from foreign universities, 10 from other universities in Sri Lanka and the rest from University of Colombo.

Surface water modeling, ground water modeling, flood mitigation and sustainable watershed management, modeling of an early warning and strategic tsunami risk assessment were some of the topics that were discussed during this workshop.

The following resource personnel from the industry and academics attended the workshop.

Name	Affiliation	Title of the Talk
Professor S. S. L. Hettiarachchi Senior Professor	Hydraulic & Water Resources Engineering Division, Department of Civil Engineering, University of Moratuwa, Sri Lanka.	Mathematical and physical modeling for early warning and strategic tsunami risk assessment
Dr. Jayantha Obeysekera Chief Modeler	Hydrologic & Environmental Systems Modeling, South Florida Water Management District, West Palm Beach, Florida, USA	Introduction to surface water and ground water modeling with applications
Dr. Methika Vithanage Group Leader	The Chemical and Environmental Systems Modeling Research Group, Institute of Fundamental Studies Sri Lanka.	Variable density flow and transport modeling: impact of tsunami in Sri Lanka
Dr. R.L.H.L. Rajapakse Senior Lecturer,	Department of Civil Engineering, University of Moratuwa, Sri Lanka.	Integrated surface water and groundwater modeling approach for flood mitigation and sustainable watershed management

6.3.2 Workshop on Insurance and Actuarial Science

Workshop on Insurance and Actuarial Science was held on 14th March, 2014 from 8.00 am to 4.00 pm at the Department of Mathematics, University of Colombo in collaboration with Actuarial Association of Sri Lanka. Mr. C.T.A. Schaffter, Deputy Chairman, Janashakthi PLC, served as the Chief Guest. Dr. Jagath K Wejerathna, Head, Department of Mathematics, University of Colombo chaired the workshop.

Around 80 participants attended the workshop out of which 20 were from industry and the others were from foreign/local academia and undergraduates from other universities in Sri Lanka and from University of Colombo.

Scope of Actuarial work at a life insurer, weather based crop insurance, recent regulatory changes in Sri Lanka, Human mortality and cost of life insurance were some of the topics discussed during the workshop.

The following resource persons from the industry as well as from academics attended this event.

Name	Affiliation	Title of the Talk
Prof. Ramkrishna Lahu Shinde Professor and Head	Department of Actuarial Science ,Director, School of Mathematical Sciences, North Maharashtra University Jalgaon, India	Weather based crop insurance Human mortality pattern and total cost of life insurance
Mr. Sujeewa Fernando Head	Actuarial Branch Janashakthi Insurance PLC	An outline of rule based and risk based frameworks of life insurance business b
Mr. Pushpakumar Gunasekera AIAA, AIAI Consultant	NMG Consulting Group	Recent regulatory changes in Sri Lanka – Opportunities to actuaries
Ms. Devindi Samaranayake Assistant Manager	LOLC Insurance	Mortality studies in actuarial science by
Ms. Shashika Vasana Hewamasmulla Senior Executive	AIA Insurance Lanka PLC	Solvency and interest rate risk
Mr. Jaap Plugge Consultant Actuary	Sri Lanka Insurance Corporation	Scope of Actuarial work at a life insurer

6.3.3 Workshop on Financial Models

Workshop on Financial Models was held on 18th March, 2014 from 8.00 am to 4.00 pm at the Department of Mathematics, University of Colombo as a part of International forum for Mathematical Modeling. Dr. Sapto Wahtyu Indratno, Faculty of Mathematics and Natural Science, Institute of Technology Babdung,

Indonesia, and Dr. Oliver Tse, Department of Mathematics, University of Kaiserslautern, Germany chaired the workshop.

Around 90 participants attended this workshop. Among the participants 20 were from industry and others from foreign/local academia and undergraduates from other universities in Sri Lanka and from University of Colombo.

The following foreign and local speakers were invited from industry as well as from the academics to discuss topics related to Forex market, Portfolio Management, risk management and Hedging.

Name	Affiliation	Title of Talks
Prof. Nicolas Privault	Division of Mathematical Sciences, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore	Convex concentration inequalities in risk management
Ms. Manohari Gunawardhena Senior Vice President	DFCC Bank	Portfolio Management
Mr. Anuk Jayasuriya Senior Associate Vice President	Equity Research Division Copal AMBA	Introduction to Real Option Valuation in Investment Appraisal
Ms. Devindi Samaranayake Assistant Manager	LOLC Insurance	
Ms. Sanjeewani Arachchi Senior Associate Vice President	Quantitative Services Division Copal AMBA	Hedging with Derivatives
Mr. Priyan Fernando Vice President	Quantitative Services Division Copal AMBA	An Introduction to Differential Evolution
Mr. Sanjaya Kalisada Assistant General Manager – Group Treasury	LOLC Group	Forex Market

6.3.4 Workshop on Scientific Computing

Workshop on Scientific Computing was held from 22nd March, 2014 to 24th March, 2014 at the Department of Mathematics, University of Colombo to train students in the use of Scientific Python programming language. This workshop was conducted

by Dr. Aleksander Gram, Faculty of Maritime Studies and Transportation (FPP), University of Ljubljana, Slovenia who is an expert in Python programming language.

Junior staff and PhD/ MPhil students attached to Department of Mathematics, University of Colombo attended this workshop. Also PhD/ MPhil fellows from Kathmandu University, Nepal and Nigeria attended this workshop.

6.4 Mini-conference Mathematical Modeling and Systems Approaches in Urban Health and Dengue

A mini-conference was held on Mathematical Modeling and Systems Approaches in Urban Health and Dengue, in the Faculty of Medicine, Colombo on 17th of March 2014. This was parallel to the International Conference on Mathematical Modeling for the Advancement of Interdisciplinary Sciences organized by the Research and Development Center for Mathematical Modeling, the Department of Mathematics, University of Colombo. The Mini-Conference was collaboration between Department of Clinical Medicine and Department of Mathematics of University of Colombo.

More than 30 participants attended this programme from University of Colombo, University of Kelaniya, United Nations University, Colombo Municipal Council, Department of Census and Statistics, Cardiology-NHSL, etc.

The following speakers were invited from Faculty of Medicine, University of Colombo, Department of Census and Statistics, Department of Sociology, University of Colombo, Department of Mathematics, University of Colombo, Department of Public Health, University of Kelaniya, Department of Geography, University of Colombo and United Nations University to discuss about concepts related to urban health and well-being and dengue and systems Science.

Name	Affiliation
Prof. Saroj Jayasinghe	Faculty of Medicine , University of Colombo
Dr P. Kariyawasam	Chief Med Officer of Health, Colombo
Dr. Jose Siri Research Fellow	United Nations University, Malaysia
Mrs. InduBandara Director	Department of Census and Statistics
Dr. Nishara Fernando	Department of Sociology, University of Colombo
Dr. Carukshi Arambepola,	Department of Community Medicine, University of Colombo

Dr . S. S. N. Perera,	Department of Mathematics, University of Colombo
Prof. A. Pathmeswaran	Department of Public Health, University of Kelaniya
Prof. Lasantha Manawadu	Department of Geography, University of Colombo

6.5 Mathematical Modeling Week

In order to give hands on experience of mathematical modeling, A Mathematical Modeling week was organized from 17th March, to 21st March, 2014 at the Department of Mathematics, University of Colombo parallel to the International forum for Mathematical Modeling.

This was conducted with the help of local and foreign experts from industry and faculty from universities in Germany, Singapore, India, Nepal, Slovenia and Indonesia. The Modeling Week was aimed to provide hands on experience in mathematical modeling for the interest community.

The main aim of organizing a modeling week was to train students to solve real world problems using mathematical modeling. Students were put into groups and were given real world problems to solve. The resource persons comprised of foreign and local professional from industry and academics. Due to the fact that professionals from industry were present, students were able to foster links with the industry.

6.5.1 Objectives

- Train students to solve real word problems using mathematical modeling and to use it as a research tool.
- Foster links with industry.
- Understand the principle of science through their applications in industry.
- Help them choose research topics related to mathematical modeling.
- Promote the use of mathematical methods and models in industry.
- Encourage collaboration, increase research confidence and enhance communication skills.
- To develop basic programming skills and provide a tool to solve modeling problems
- To develop a culture among students and share good practice and recognize of the importance of modeling in Mathematics.

6.5.2 Target Group

- Senior undergraduate students
- Recent Graduates
- Masters Students
- Beginners in Mathematical Modeling, Preferably in Mathematics, Physics and Statistics.

Around 50 participants from all over Sri Lanka from various disciplines such as Mathematics, Statistics, Physics, and Engineering participated for this event. There were 14 students from Rajarata Univeristy, 3 from University of Moratuwa, 8 from University of Kelaniya, 2 from Vavuniya Campus and University of Jaffna. Dr. Aleksander Gram, Faculty of Maritime Studies and Transportation (FPP), University of Ljubljana, Slovenia, chaired the programme.

The foreign and local experts from industry as well as from the academia presented 11 real world problems to the students. Students were put into groups and had to come-up with a solution during the week. On the last day they presented their solutions to the audience which comprised of students, foreign and local resource persons and faculty. The Resource Persons are as follows. The judges selected 1st and 2nd places.



Name	Affiliation
Dr. Yudi Soeharyadi	Faculty of Mathematics and Natural Science, Institute of Technology Bandung, Indonesia
Dr. Dil Bahadur Gurung	Department of Mathematics, School of Natural Sciences, Kathmandu University
Prof. Nicolas Privault	Nanyang Technological University Singapore
Dr. Crista Arangala	Elon University, Elon, North Carolina
Dr. Edy Soewono	Faculty of Mathematics and Natural Science, Institute of Technology Bandung, Indonesia
Dr. Sapto W. Indratno	Faculty of Mathematics and Natural Science, Institute of Technology Bandung, Indonesia
Dr. Chula Jayawardene	Department of Mathematics ,University of Colombo
Mr. Anuradha Mahasinghe	Department of Mathematics, University of Colombo
Dr. Naleen Ganegoda	Department of Mathematics University of Sri Jayawardanapura
Dr. Sohan Dharmarajah	CEO Neotenicity
Mr. Anuk Jayasuriya	Senior Associate Vice President Equity Research Division Copal AMBA
Mr. Sanjaya Kalidasa	Assistant General Manager –Group Treasury LOLC Group

The panel of Judges:

Name	Affiliation
Dr. Oliver Tse	Department of Mathematics, University of Kaiserslautern, Germany
Dr. Torben Fattler	Department of Mathematics, University of Kaiserslautern, Germany
Dr. Aleksander Gram	Faculty of Maritime Studies and Transportation (FPP), University of Ljubljana

7. Outcomes of the IFM²-2014

- Strengthen existing collaboration and formed new collaboration with international researches from various countries.
- Networking of researchers in various fields
- Knowledge transfer among academia and students
- Enhanced Links with Industry
- Start up of two PhD research projects in collaboration with University of Ljubljana, Slovenia
- Future Student exchange programs with foreign universities.

8. Acknowledgements

None of the above activities would have been possible if not for the financial aid received from the DAAD and the support received by our partner universities TUKL, ITB and KU. Further we greatly acknowledge the financial support received by University Grants Commission of Sri Lanka, HETC project and our local sponsors. Also we are thankful to all resource personnel and participants who helped to make this forum a success.

