International Project Research

2nd Malaysia-Japan Symposium on Mathematical and Statistical Modelling

Pulai Spring Resort, Johor Bahru, Malaysia

2026 **9.3** *Thu* *9:00-17:30*

UTM UNIVERSITI TEKNOLOGI MALAYSIA · MYHIMS SOLUTIONS PLT · 九州大学 KYUSHU UNIVERSITY · Institute of Mathematics for Industry Kyushu University · MfIP Mathematics for Industry Platform · Joint Research Center for Advanced and Fundamental Mathematics-for-Industry · NEXUS

Program Schedule

9:00 AM-*9:05 AM*	*Opening remarks – Dr. Arifah Binti Bahar, Director of UTM-CIAM, UTM*
9:05 AM-*9:10 AM*	*Opening remarks – Prof. Fumikazu Sato, Deputy Director of IMI, Kyushu University*
9:10 AM-*9:35 AM*	*UTM Student Team Presentation (3 students) (Ang Chin Xiang, Aina Nuha Binti Che Mahadzir, Fatanah Binti Hamzah)*
9:35 AM-*10:00 AM*	*KU Student Team Presentation (4 students) (Haruka Suga, Taiga Kadowaki, Yoshimichi Hayashi, Go Hashimoto)*
10:00 AM-*10:30 AM*	*Refreshment Break*
10:30 AM-*11:30 AM*	*Keynote Lecture – Prof. Dr. Normah Maan (UTM)*
11:30 AM-*12:00 AM*	*Invited Talks by UTM & KU – Prof. Dr. Pierluigi Cesana (IMI, Kyushu University)*
12:00 PM-*12:30 PM*	*Invited Talks by UTM & KU – Dr. Jianquan Liu (NEC)*
12:30 PM-*2:30 PM*	*LUNCH & NETWORKING*
2:30 PM-*3:00 PM*	*Invited Talks by UTM & KU – Emeritus Professor Dato' Dr. Mohamed Ridza Wahiddin*
3:00 PM-*3:30 PM*	*Invited Talks by UTM & KU – Assoc. Prof. Dr. Atsushi Tero (IMI, Kyushu University)*
3:30 PM-*3:35 PM*	*Summary – Professor Dr. Duy Hien Nguyen (IMI, Kyushu University)*
3:35 PM-*3:40 PM*	*Summary – Dr. Ahmad Qushairi Bin Mohamad (UTM)*
4:30 PM-*5:30 PM*	*Closing Ceremony & Refreshment*

* 3:45-4:30 PM: ISMI invites MJSMSM participants to attend the following lecture on site.
Industry Keynote Talk - Mr. Mustaffa Ramly
Title: Mathematics and AI Behind AirAsia Operations

Opening Remarks

Arifah Binti Bahar

Universiti Teknologi Malaysia (UTM)
Director of UTM-CIAM, Associate Professor, Doctor

Personal History

Dr. Arifah Bahar obtained her Ph.D. in Stochastic Dynamics from the University of Strathclyde. She is Director of the UTM-Centre for Industrial and Applied Mathematics (UTM-CIAM), a founding institutional member of the Asia Pacific Consortium of Mathematics for Industry. She promotes research in mathematical and statistical modelling, simulation, and optimisation for industrial processes. Her research interests include stochastic modelling, groundwater modelling, statistical data analysis, and uncertainty quantification.

Fumikazu Sato

Institute of Mathematics for Industry, Kyushu University
Professor, Leader of Division of Strategic Liaison

Personal History

In government agencies, including the Ministry of Economy, Trade and Industry (METI) and the Cabinet Office (CAO), I was primarily responsible for science, technology and innovation policy, as well as industry–academia collaboration policy. In the Division of Strategy & Liaison, I promote collaboration frameworks and future strategies bridging academia and industry through mathematics. I am also interested in applying mathematics to cutting-edge fields such as quantum technology.

UTM Student Presentations

Ang Chin Xiang

Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia (UTM)
PhD Student (D2)

Omega Limiting Set of b-Bistochastic Quadratic Stochastic Operators

Quadratic Stochastic Operators (QSOs) are widely used in population genetics. A class of QSO formed by taking the b-majorization on the operator is the b-bistochastic QSO. This article describes the omega limiting set of the b-bistochasitc QSO on any finite dimensional simplexes as it is one of the main problem in nonlinear operator theory.

Aina Nuha Binti Che Mahadzir

Faculty of Electrical Engineering, Universiti Teknologi Malaysia
Master's student (M1)

Explainable Deep Learning Model using Large Language Model for Palm Oil Fresh Fruit Ripeness

XAI Palm Oil Inspector presents an explainable AI framework for FFB ripeness classification and harvest recommendation per MPOB standards. A YOLOv8m detector with colour-focused augmentation improves detection accuracy over the original dataset. Combined with Qwen2.5-VL and DeepSeek R1 reasoning, the pipeline embeds MPOB domain rules to deliver transparent, field-applicable harvest decisions.

UTM Student Presentations

Fatanah Binti Hamzah

Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia
Master's student(M2)

Two-Dimensional Dam-Break Debris Flow Model Incorporating Voellmy Rheology, Earth pressure coefficient and Coriolis Parameter

Debris flow is a known natural disaster that takes place in Malaysia over the years. Representing its behaviour through mathematical modelling remains a challenge until this date. This study introduces a two-dimensional depth-averaged debris flow model incorporating Voellmy rheology, earth pressure coefficient and Coriolis effect for hazard assessment simulation.

KU Student Presentations

Haruka Suga

**Joint Graduate School of Mathematics for Innovation,
Kyushu University
Master's Student (M2)**

A Mathematical Model of Catheter-Based Treatment for Multiple Stenoses: Optimizing the Treatment Order

This study investigates the optimal treatment order to minimize total procedure time for two serial stenoses. To reduce computational costs, we simplified a Navier-Stokes flow model by Intan Diyana Munir, a UTM student, into a fitted formula. This is highly beneficial for complex blood vessels. Results reveal that prioritizing the lower stenosis significantly reduces treatment time.

Taiga Kadowaki

**Joint Graduate School of Mathematics for Innovation,
Kyushu University
Master's Student (M2)**

Stochastic Growth Modeling of Vascular Plaque Dynamics and Optimization of Catheter-Based Drug Delivery

This study proposes a stochastic growth model to simulate vascular plaque dynamics and optimize targeted drug delivery. By formulating particle advection-diffusion as an absorbing Markov process, we efficiently compute reaching probabilities and derive optimal dosing curves for catheter positioning, drastically reducing the computational costs of traditional fluid dynamics.

KU Student Presentations

Yoshimichi Hayashi

Graduate School of Mathematics, Kyushu University
Master's Student (M2)

Application of Bioconvection Model Framework to Vegetation Distribution

We propose a novel mathematical framework applying bioconvection and partial differential equation (PDE) models to vegetation distribution patterns. Extending previous research on biological cell movement and pattern formation, this joint study with UTM aims to analyze ecological spatial structures, establishing a theoretical foundation for modeling diverse vegetation dynamics.

Go Hashimoto

Joint Graduate School of Mathematics for Innovation, Kyushu University
PhD Student (D3)

Description of hybrid systems by term rewriting.

A hybrid system combines continuous changes, such as those in differential equations, with discrete control. Rewriting systems are used to determine whether a target state can be reached using given rewriting rules. Here, we consider the collision problem in hybrid systems using "second-order" term rewriting.

Keynote Lecture

Normah Maan

Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia (UTM)
Professor Director, UTM Accreditation Centre (UTM ACe), Universiti Teknologi Malaysia

Personal History

Professor Dr. Normah Maan is a Professor in the Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia, and Director of the UTM Accreditation Centre. Her expertise includes mathematical modelling, dynamical systems, delay differential equations, fuzzy set theory, and mathematical biology. With over 28 years at UTM, she has contributed to research, postgraduate supervision, academic quality assurance, and accreditation, while applying mathematics to healthcare, AI, and industrial innovation.

Mathematical Foundations of AI for Precision Oncology: A Delay–Fuzzy Control Framework for Tumour–Immune–Metabolic Dynamics

Breast cancer remains one of the most challenging diseases to model due to the complex interactions among tumour cells, immune responses, metabolic regulation and therapeutic interventions. Understanding these interconnected biological processes requires mathematical frameworks that not only describe disease progression but also support prediction, optimisation and intelligent decision-making. This keynote presents a control-oriented mathematical modelling framework that integrates tumour growth, natural killer (NK) cells, CD8! T cells, glucose-mediated metabolic dynamics, immune suppression, treatment delay and parameter uncertainty within a unified delay differential equation model.

The presentation demonstrates how advanced mathematical modelling can reveal the dynamic mechanisms governing tumour progression, immune surveillance and immune escape while accounting for biological uncertainty through fuzzy modelling. The incorporation of optimal control theory provides a systematic approach for identifying treatment strategies that minimise tumour burden while improving therapeutic efficiency. Numerical investigations further illustrate how hyperglycaemia, delayed immune activation and treatment timing influence long-term disease outcomes and therapeutic effectiveness.

Beyond the mathematical analysis, this keynote highlights the emerging role of artificial intelligence in mathematical oncology, where AI-driven parameter estimation, model calibration, predictive analytics and personalised treatment optimisation complement mechanistic mathematical models. The integration of mathematical modelling, optimal control and artificial intelligence offers a promising pathway towards precision medicine and intelligent healthcare systems. More broadly, this work illustrates how industrial mathematics can bridge mathematics, biomedical science and AI to address complex real-world healthcare challenges and support evidence-based clinical decision-making.

Invited Talks

Pierluigi Cesana

Institute of Mathematics for Industry, Kyushu University
Professor, Leader of Division of International Affairs

Personal History

Pierluigi Cesana obtained his Ph.D. in Applied Mathematics from the International School for Advanced Studies in Trieste, Italy. He held postdoctoral positions at Caltech and the Mathematical Institute at Oxford before moving to La Trobe University as a Senior Research Fellow. Since 2017, he has been based at Kyushu University's Institute of Mathematics for Industry. His research combines calculus of variations, probability theory, and AI/data science.

Mathematical Modeling and AI for Materials Design and Chemical Innovation

In this talk, I will present examples from materials science and chemistry showing how AI methods combined with human scientific expertise can support the design, optimization, and control of advanced materials and chemical systems. The focus is on approaches that remain effective in small-data regimes by incorporating physical intuition, structural modeling, and domain knowledge.

Rather than relying on large datasets, these methods integrate modeling and scientific understanding to improve interpretability and robustness. Case studies will include molecular machines, and related systems, highlighting how mathematics, AI, and domain knowledge together enable new opportunities for discovery and control.

Invited Talks

Jianquan LIU

NEC Laboratories Asia Pacific (NLAP), Singapore
Senior Director | IPSJ Fellow | Visiting Professor at Nagoya University

Personal History

Dr. Jianquan Liu is Senior Director of NEC Laboratories Asia Pacific (NLAP) and Senior Principal Researcher at NEC Corporation. He is also a Visiting Professor at Nagoya University and an Adjunct Professor at Hosei University. He received his B.Eng. from Shantou University, China, and his M.Eng. and Ph.D. in Computer Science from the University of Tsukuba, Japan. Before joining NEC, he worked as a Software Engineer at Tencent Inc.

Engaging Video Analytics and Generative AI

In this talk, Dr. Jianquan Liu presents an industry perspective on the convergence of video analytics and generative AI. The talk begins with an overview of video analytics, covering advancements in action recognition, object tracking, human-object interactions, scene recognition, and behavioral pattern analysis. These technologies enable efficient extraction, retrieval, visualization, and summarization of video content. The presentation then explores the impact of generative AI, particularly large language models (LLMs), on video understanding. It discusses how LLMs enhance object recognition, semantic segmentation, action recognition, captioning, visual question answering, and storytelling. Dr. Liu provides industry case studies to illustrate these applications while also addressing limitations and challenges. The talk introduces NEC's narrative summarization framework, designed to tackle key challenges in video analytics. It concludes with a demonstration of "Video with LLM" technology, showcasing its practical application in automating traffic accident investigation reports. This presentation offers valuable insights into the current state and future potential of AI-driven video intelligence, bridging the gap between technical innovation and practical application for both industry professionals and general audiences.

Dato' Dr Mohamed Ridza Wahiddin FASc

Senior Fellow, MIMOS Berhad, MRANTI Park, 57000 Kuala Lumpur
Emeritus Professor

Personal History

Prof. Ridza obtained his Ph.D. in Quantum Optics from UMIST, UK, in 1989 and a DSc from UMIST in 2004. He has received national and regional recognition and is a Fellow of several Malaysian scientific societies. He formerly served as Vice-Chancellor of Universiti Sains Islam Malaysia. In 2024, IIUM conferred him the title of Emeritus Professor. He is currently Senior Fellow at MIMOS Berhad and Deputy President of Akademi Profesor Malaysia.

A Quantum Machine Learning Framework for Hybrid Anomaly Detection in Cyber Financial Systems

Quantum machine learning (QML) is increasingly explored as a framework for modelling complex, high-dimensional systems characterised by nonlinear interactions and rare events. In parallel, cyber incidents are being recognised as potential sources of financial instability as digitalisation intensifies interdependence between technological infrastructures and financial markets. Existing monitoring tools typically analyse cyber and market indicators separately, limiting their ability to detect early stage instability arising from their interaction. This paper proposes a conceptual hybrid quantum–classical anomaly detection architecture for cross-domain systems, with cyber–financial stability serving as a motivating application. The framework integrates cyber and market indicators into a unified representation through quantum feature mapping, with the potential to model nonlinear dependencies that are difficult to capture using classical methods. A Grover inspired amplitude amplification mechanism is incorporated to enhance the identification of rare or subtle instability signals indicative of emerging cyber–financial stress. Drawing on established financial stability frameworks from the IMF and CPMI–IOSCO, the proposed architecture illustrates how quantum-enhanced learning can support early-warning analysis in interconnected cyber–physical systems. As a conceptual study, this work establishes a foundation for future empirical validation, simulation-based stress testing, and the development of quantum enhanced monitoring and supervisory tools aimed at strengthening financial stability in an increasingly digital and interconnected environment.

Invited Talks

Atsushi Tero
Institute of Mathematics for Industry, Kyushu University
Associate Professor

Personal History
My research explores how organisms acquire refined mechanisms through long-term adaptation and translates such life phenomena into mathematical models for industrial applications. I focus on adaptive networks, including railway systems, ant trails, blood vessels, and leaf veins, where frequently used paths develop while unused paths degenerate. My aim is to understand how these network topologies form, evolve, and vary in scale, as seen in capillaries and aortas. I also study action control through biological rhythms and voluntary morphological changes.

Mathematical Modeling of Formation, Adaptation, and Repair in Networks

Adaptive networks appear in many biological, social, and artificial systems, including slime mold transport networks, vascular systems, plant veins, road networks, and infrastructure systems. Although these systems differ greatly in scale and material, they often share common features: local responses to flow or demand, global improvement of transport efficiency, robustness against damage, and reorganization under changing environments. In this talk, I will introduce mathematical models for adaptive network dynamics and discuss how they can provide a common theoretical framework for understanding network formation, optimization, and repair.

Starting from biological transport networks such as Physarum and vascular systems, I will explain how simple feedback rules between flow and conductance can generate efficient and robust network structures. I will then discuss extensions toward damaged or externally repaired networks, where the order and location of intervention can strongly affect recovery. These examples suggest that adaptive networks can be studied not only as biological phenomena but also as a general mathematical principle connecting living systems, infrastructure, and collective organization.

summary

Duy Hien Nguyen

Institute of Mathematics for Industry, Kyushu University
professor

Ahmad Qushairi bin Mohamad

Universiti Teknologi Malaysia (UTM)
Senior Lecturer

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Prof. Fumikazu Sato
Leader of Division of Strategic Liaison,Institute of Mathematics for Industry (IMI)

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