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Position: DEPUTY DIRECTOR OF UTM-CIAM

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1.Title of Research Project	Malaysian Mathematics in Industry Study Group 2023 (MALAYSIAN MISG 2023)			
2.New Proposal	New			
3.Type	Grant for International Project Research			
4.Category	Workshop (I)			
5.Principal Investigator	Name	Zaitul Marlizawati Zainuddin		
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6.Project Period	2023/11/20 - 2023/11/22			
7.Key Words	Quadruple helix framework, industry-academia collaboration, statistical inference, optimization, mathematical modelling			
8.Number of	64			

9. Abstract for Research Report

Mathematics in Industry Study Group is a collaborative problem-solving platform, uniting applied mathematicians to address real-world challenges across industries. Originating at Oxford University in the 1960s, this format has been instrumental in fostering practical solutions globally. At Universiti Teknologi Malaysia (UTM), we take pride in being pioneers, having introduced this study group to Malaysia since 2011. Our commitment continues and is evident in the recent organization of the 4th Malaysia Mathematics in Industry Study Group (MMISG2023) held at Menara Razak, Universiti Teknologi Malaysia, Kuala Lumpur, from November 20th to 22nd, organized by UTM Centre for Industrial and Applied Mathematics (UTM-CIAM). It was also made possible through the joint efforts of UTM Department of Mathematical Sciences, Faculty of Science; the Institute of Mathematics for Industry at Kyushu University, Japan; and MYHIMS Solutions LLP.

In general, the primary objective of Malaysia Mathematics in Industry Study Group-MMISG is to bridge the gap between academia and industry in Malaysia. The event serves as a convergence of academic rigor and industrial pragmatism, where the world of mathematical theory meets the complex, multifaceted issues faced by local industries. It is a platform for STEM researchers to apply their expertise to solve industrial relevant problems, fostering a collaborative spirit between the two domains.

At MMISG2023, five industries presented their industrial problems. The problems spanned from model reconstruction at archaeological sites to cutting-edge developments in the logistic industry, and from forecasting volatility of agricultural commodity prices to optimizing operations processes. The five industrial problems from the five industries are as follows:

i)Predictive Modeling of Pipe Burst Towards Sustainable Non-Revenue Water from Ranhill SAJ Sdn. Bhd.

ii)Tackling Carbon Emissions: Strategies for Medium and Heavy-Duty Trucks from Total Logistic Services Sdn. Bhd.

iii)Price Forecasting Model for Main Vegetables in Malaysia from MYHIMS Solutions LLP

iv)Transient Modeling of Subsea Cable Laying from Ifactors Sdn. Bhd.

v)3D Shape Reconstruction of Charcoal Chamber Monument from Langkawi Development Authority (LADA)

To tackle the array of industrial issues, five cohesive sub-groups were formed, each guided by selected domain advisors. Within each group, members (termed as contributors) comprising of mathematicians, engineers, computer scientists played crucial roles in identifying key scientific issues and mathematical challenges. They actively generated accessible ideas, leveraging on mathematical modelling, analysis, and computation to provide valuable insights into the problems at hand. More than 50 contributors from ten institutions, both local and international, including Universiti Teknologi Malaysia, Universiti Malaya, Universiti Teknologi MARA, Universiti Malaysia Sabah, Universiti Kebangsaan Malaysia, Universiti Malaysia Terengganu, Universiti Malaysia Pahang Al-Sultan Abdullah, Universiti Teknologi Petronas, Kyushu University, Japan and Universitas Negeri Malang, Indonesia participated. Online discussions were also conducted with UTM-CIAM international partner at Oxford Centre for Industrial and Applied Mathematics (OCIAM). This collaborative effort harnessed the expertise from various institutions, enriching the event with a wide spectrum of mathematical and statistical approaches, all unified in the common goal of effective problem-solving. This initiative seamlessly aligns with UTM's mission to actively engage in both local and global networks, fostering partnerships with diverse organizations and industries to drive innovation through innovative solutions.

The MMISG2025 has once again proven to be a pivotal event in fostering collaboration between academia and industry and further solidifies the event's reputation as a catalyst for innovation and problem-solving. It is evidenced from the positive feedback received from the participants: industrial representatives and contributors.

In addition to the solutions and recommendations generated for the industry, MMISG2023 has also catalyzed other significant outcomes, highlighting its impact as a significant program of Mathematics in Industry. Preparations are underway for Memorandum of Understanding and Letters of Collaboration between UTM-CIAM and the participating industries. Furthermore, technical reports have been published, and the MI Lecture Note serves as another avenue for disseminating MMISG outputs. Moreover, MMISG2023 marked the beginning of a larger project focused on system development for Ifactors Sdn. Bhd. The continuation of studies initiated during MMISG2026 is anticipated, with the expectation of yielding even more impactful results for the participating industries.

MALAYSIA MATHEMATICS IN INDUSTRY STUDY GROUP (MMISG2023)

20-22 November, 2023, UTM KUALA LUMPUR, Malaysia

1.0 Introduction

The MMISG2023 was held at Universiti Teknologi Malaysia, Kuala Lumpur, from November 20th to 22nd, 2023, organised by UTM Centre for Industrial and Applied Mathematics (UTM-CIAM) in collaboration with UTM Department of Mathematical Sciences, Faculty of Science; the Institute of Mathematics for Industry at Kyushu University, Japan; and MYHIMS Solutions LLP.

The study group is a collaborative problem-solving platform, uniting applied mathematicians and STEM researchers to address real-world challenges across industries. Among the programme objectives are to provide exposure and platform to academics, especially Mathematical Sciences and Engineering community to industrial problems that can be solved using mathematical or statistical techniques and advancement of knowledge and technology and also to enhance the collaboration between industries in Malaysia and Institutions of Higher Education through quadruple helix framework (involving government, industry, academia and community).

2.0 Industrial Problems

There are five industrial problems from five industries as follows:

i) Predictive Modeling of Pipe Burst Towards Sustainable Non-Revenue Water from Ranhill SAJ Sdn. Bhd.
ii) Tackling Carbon Emissions: Strategies for Medium and Heavy-Duty Trucks from Total Logistic Services Sdn. Bhd.
iii) Price Forecasting Model for Main Vegetables in Malaysia from MYHIMS Solutions LLP
iv) Transient Modeling of Subsea Cable Laying from Ifactors Sdn. Bhd.
v) 3D Shape Reconstruction of Charcoal Chamber Monument from Langkawi Development Authority (LADA)

3.0 Output and Impact

To tackle the array of industrial issues, five cohesive sub-groups were formed, each guided by selected domain advisors. Within each group, members, termed as contributors—comprising mathematicians, engineers, and computer scientists—played crucial roles in identifying key scientific issues and mathematical challenges. They actively engaged in formulating accessible ideas, leveraging mathematical modeling, analysis, and computation to provide valuable insights into the problems at hand. More than 50 contributors from ten institutions, both local and international, including UTM, Universiti Malaya (UM), Universiti Teknologi MARA (UiTM), Universiti Malaysia Sabah (UMS), Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Terengganu (UMT), Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA), Universiti Teknologi Petronas (UTP), Kyushu University, Japan, and Universitas Negeri Malang, Indonesia participated. Online discussions were also conducted with UTM-CIAM international partners.

This collaborative effort harnessed expertise from various institutions, enriching the event with a wide spectrum of mathematical approaches, all unified in the common goal of effective problem-solving. This initiative seamlessly aligns with UTM's mission to actively engage in both local and global networks, fostering partnerships with diverse organizations and industries to drive innovation through innovative solutions.

The 4th MMISG also marked a new model of MMISG emphasizing efficiency and effectiveness as primary objectives. Enhancements have been implemented across three key components of MISG:

i) Event Management

The duration of MISG has been reduced to two and a half days, nevertheless, the structure of the study group remains unchanged. The duration is believed to be the optimal duration to make sure that the participants especially the industry representatives (they cannot be out of office for too long) could give their full participation and this was witnessed throughout the event. Hence, this strategy seems to work well.

ii) Expert Management

To ensure the gathering of suitable expertise and the acquisition of optimal input from academics, an "Interest Form" was made available on the MMISG2023 website. Academics interested in participating as contributors in MMISG filled out this form, and they were then subsequently assigned to relevant problems by the secretariat. There were over 50 experts and contributors, all of whom demonstrated full commitment to the problem-solving activities.

iii) Output Management

The problem-solving activities adhered to the principle of being “outcome-based and result-oriented”, aligning with the needs and requirements of our industry partners. One advantage of the approach is that the final solutions are derived from the discussion and agreement of the industry.

In addition to the solutions and recommendations generated for the industry, MMISG2023 has also catalysed other significant outcomes of Mathematics in Industry. Documentation of collaboration between UTM-CIAM and the participating industries are in progress. Furthermore, technical reports have been published, and the MI Lecture Note serves as another avenue for disseminating MMISG outputs. The continuation of studies initiated during MMISG2023 is anticipated, with the expectation of yielding even more impactful results for the participating industries.

4.0 Conclusion

MMISG2023 has once again proven to be a pivotal event in fostering collaboration between academia and industry. We received positive feedback from participants—industrial representatives and contributors via feedback survey. This edition of MMISG further solidifies the event’s reputation as a catalyst for innovation and problem-solving, showcasing the power of interdisciplinary collaboration in addressing real-world challenges.

5.0 Acknowledgement

We extend our sincere gratitude to the Institute of Mathematics for Industry (IMI), Kyushu University, for the support through the Joint Usage/Research Center at Kyushu University (FY2023 Workshop (I) “MMISG2023” (2023b003)). This support was utilized to finance the experts who played pivotal roles in the problem-solving process.

6.0 Recommendation

The funding provided is highly beneficial for the experts but it poses a challenge for the person in charge of the management of the programme. It is recommended that in future instances, this funding be channeled through the institution of the person in charge. This approach ensures smoother transfer processes and facilitates proper acknowledgment of both the recipients and their respective institutions.

PROGRAMME

20 November 2023, Monday

Time	Activity	Venue
0830 – 0915	Registration & Morning Tea	Menara Razak Seminar Hall/Banquet Hall
Morning Session 0915 - 1215		
0915 – 0945	Opening Ceremony/Photo Session	Menara Razak Seminar Hall
0950 – 1010	Ranhill SAJ Problem Presentation	
1015 – 1035	MYHIMS Solutions Problem Presentation	
1040 – 1100	Ifactors Sdn Bhd Problem Presentation	
1105 – 1125	TLS Problem Presentation	
1130 – 1150	LADA problem Presentation	
1200 – 1400	Lunch Break	Banquet Hall
Afternoon Session 1400 - 1730		
1400 – 1730	Group Formation/Group Discussion	Room 2, 3, 4, 5, 7
1530 – 1600	Afternoon Tea	Banquet Hall

PROGRAMME

21 November 2023, Tuesday

Time	Activity	Venue
Morning Session 0830 – 1230		
0830 – 1230	Group Discussion	Room 2, 3, 4, 5, 7
1000 – 1030	Morning Tea	Banquet Hall
1230 – 1400	Lunch Break	Banquet Hall
Afternoon Session 1400 – 1730		
1400 – 1730	Group Discussion	Room 2, 3, 4, 5, 7
1530 – 1600	Afternoon Tea	Banquet Hall

22 November 2023, Wednesday

Time	Activity	Venue
Session 1 0830 – 1100		
0830 – 1100	Group Discussion	Room 2, 3, 4, 5, 7
0930 – 1000	Morning Tea	Banquet Hall
Session 2 1105 – 1215		
1105 – 1200	Output Presentation to The Industry	Room 2, 3, 4, 5, 7
1205 – 1215	Closing Ceremony	Banquet Hall
1215	Lunch	Banquet Hall