



**SOUTH EAST ASIAN MATHEMATICAL SOCIETY**

# **FINAL REPORT**

## **SEAMS SCHOOL 2016: Mathematical and Numerical Modelling for Wave Dynamics**

**Institut Teknologi Bandung  
1-9 June 2016**

**Organized by**

**Industrial & Financial Mathematics Research Group  
Institut Teknologi Bandung**

**with the support of**

- **CIMPA (Centre International de Mathematiques Pures et Appliquees**
- **Faculty of Mathematics and Natural Sciences – Institut Teknologi Bandung**
- **EFFRaCC Research Grant, British Council**
- **Labmath Indonesia**

**2016**

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## SEAMS SCHOOL 2016:

### Mathematical and Numerical Modelling for Wave Dynamics Institut Teknologi Bandung, Bandung, Indonesia, 1-9 June 2016

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#### 1. Summary

This SEAMS School was focused on the basic knowledge of wave dynamics, with applications on environmental flows, wind waves, ocean waves, including tsunami. The lecture started with basic notions in Functional Analysis and variational formulation of several partial differential equations. Then it is followed with variational formulation of Boussinesq equations. Two types of Boussinesq equations were formulated. Numerical methods discussed in this SEAMS School were finite difference, finite volume, and finite element. Several hands-on tutorials were conducted. From these tutorials participants could directly follow and learn how to implement those numerical methods. By doing this, participants could explore their numerical skill and got deeper insight on wave phenomena. Software Hawassi was also introduced. This software is built using the finite element method of the variational Boussinesq equations. Participants were guided to use Hawassi for simulating various ocean wave phenomena.

#### 2. Scientific Objectives and Rationale for the School

The main objective of the School is to give enough overview for participants to do research, especially on mathematical modelling and numerical simulation for wave dynamics. This issue is important, because South East Asian countries, such as Indonesia, are prone to natural disasters, such as flood, tsunami, etc. More specific objectives are explained in Section 5.

#### 3. Organizers and Instructors

Organizing committee are as follows

Name : Prof. Dr. Sri Redjeki Pudjaprasetya  
Institution : Department of Mathematics, Institut Teknologi Bandung,  
Bandung, Indonesia  
Email : [sr\\_pudjap@math.itb.ac.id](mailto:sr_pudjap@math.itb.ac.id)

Name : Prof. Dr. Leo H. Wiryanto  
Institution : Department of Mathematics, Institut Teknologi Bandung,  
Bandung, Indonesia  
Email : [leo@math.itb.ac.id](mailto:leo@math.itb.ac.id)

Name : Dr. Ikha Magdalena  
Institution : Department of Mathematics, Institut Teknologi Bandung,  
Bandung, Indonesia  
Email : [ikha.magdalena@math.itb.ac.id](mailto:ikha.magdalena@math.itb.ac.id)

Instructors in the School were

Name : Prof. Dr. Sri Redjeki Pudjaprasetya  
Institution : Mathematics Study Program, Institut Teknologi Bandung  
Email : [sr\\_pudjap@math.itb.ac.id](mailto:sr_pudjap@math.itb.ac.id)

Name : Prof. Dr. Leo H. Wiryanto  
Institution : Department of Mathematics, Institut Teknologi Bandung,  
Bandung, Indonesia  
Email : [leo@math.itb.ac.id](mailto:leo@math.itb.ac.id)

Name : Prof. E. van Groesen  
Institution : Toegepaste Wiskunde, Universiteit Twente, the Netherlands  
Labmath Indonesia, Bandung, Indonesia  
Email : [e.w.c.vangroesen@utwente.nl](mailto:e.w.c.vangroesen@utwente.nl), [groesen@labmath-indonesia.org](mailto:groesen@labmath-indonesia.org)

Name : Prof. Marian P Roque  
Institution : Department of Mathematics, University of the Philippines  
Email : [marian.roque11@gmail.com](mailto:marian.roque11@gmail.com)

Name : Dr. Didit Adytia  
Institution : Labmath Indonesia, Bandung, Indonesia  
Email : [didit@labmath-indonesia.org](mailto:didit@labmath-indonesia.org)

Name : Dr. Sudi Mungkasi  
Institution : Department of Mathematics,  
Sanata Dharma University, Yogyakarta, Indonesia  
Email : [sudi@usd.ac.id](mailto:sudi@usd.ac.id)

Guest lecturers for the last session on 9 June 2016 were:

Dr. Agus Yodi Gunawan (Mathematics ITB),

Dr. Priana Sudjono (Environmental and Management Technology, ITB),

Dr. Semeidi Husrin, (Research and Development center, Ministry of Marine Affairs and Fishery, Republic of Indonesia)

#### 4. Participants

In this SEAMS School there were 37 participants, consisting of 8 non-Indonesian and 29 Indonesian. Among them, 17 participants are female and 20 are male. We actually accept 38 participants consisting of 8 non- Indonesian and 30 Indonesian. But one Indonesian participant Irfan Said from Makassar did not come without notice. The Indonesian participants came from various regions: 1 participant from Yogyakarta, 1 participant from Makassar, 1 participant from Kendari, 2 participants from Jakarta, 2 participants from Malang, 1 participant from Surabaya. All non-ITB participants were lodged in the same hotel, Tune Hotel, located near ITB. This arrangement gave participants a big opportunity for having discussions among them.

The list of participants and their country of origin are given in the following table.

No	Name	Sex	Email	Status	Affiliation	City	Nationality
1	Faizal Ade	M	adefaizal21@yahoo.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
2	Eka Rahmi Kahar	F	ekarahmi.erk1592@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
3	Dede Tarwidi	M	dedetarwidi@telkomuniversity.ac.id	Lecturer	Telkom University	Bandung	Indonesia
4	Imam Wijaya	M	robiah.wijaya239@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
5	Viska Noviantri	F	viskanoviantri@yahoo.com	Lecturer	Bina Nusantara University	Jakarta	Indonesia
6	Anisah Ilman	F	anisahilman@gmail.com	Employee	BPPT employee	Jakarta	Indonesia
7	Aris Alfian	M	arisalfan@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
8	Ade Candra Bayu	M	ade_zildji@yahoo.co.id	Master student	Institut Teknologi Bandung	Bandung	Indonesia
9	Dian Nuraiman	M	dianuraiman@uinsgd.ac.id	Lecturer	UIN SGD	Bandung	Indonesia
10	Aulia Oktavia	F	aulia.oktavia17@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
11	Dimas Avian Maulana	M	dimasmaulana@unesa.ac.id	Lecturer	Univeristas Negeri Surabaya	Surabaya	Indonesia
12	Nashrul Millah	F	nashrulmillah53@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
13	Andi Galsan Mahie	M	andi_galsan@yahoo.com	Lecturer	Hasanuddin University	Makasar	Indonesia
14	Lusia K. Budiasih	F	lusia_kris@usd.ac.id	PhD. Student	Sanata Dharma	Yogyakarta	Indonesia
15	Nurul Huda	F	nurulh3009@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
16	Annas Nasrudin	M	a.nasrudin999@gmail.com	Master student	UIN SGD	Bandung	Indonesia
17	Zuraidah Fitriah	F	zuraidahfitriah100687@gmail.com	Lecturer	Brawijaya University	Malang	Indonesia
18	Ayu Niken	F	ayuniken35@gmail.com	Master student	Brawijaya University	Malang	Indonesia
19	Egi Safitri	F	egisafitric@gmail.com	Student	University of Halu Oleo	Kendari	Indonesia
20	Putu Veri Swastika	M	veri4putu@gmail.com	student	Institut Teknologi Bandung	Bandung	Indonesia
21	Arnasli Yahya	M	matematika.arnas@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
22	Dita Pramesti	F	ditapramesti@yahoo.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
23	Bintang Alam Semesta	M	bintang.4@students.itb.ac.id	student	Institut Teknologi Bandung	Bandung	Indonesia
24	David Eka	M	eka.putra30@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
25	Rifky Fauzi	M	rifyfauzi9@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
26	Elvi Syukrina	F	elvi.erianc@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
27	Tony Nuryaman	M	toninuryaman@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
28	Lia Yuliawati	F	liaylwt@gmail.com	PhD. Student	Institut Teknologi Bandung	Bandung	Indonesia
29	Maria A Ginting	F	mariaaginting@gmail.com	Master student	Institut Teknologi Bandung	Bandung	Indonesia
30	Osbert Bryan Villasis	M	obtvillasis@gmail.com,	PhD. Student	De La Salle University	Manila	Filipino
31	Julius Fergy T. Rabago	M	jfrabago@gmail.com	PhD. Student	Univ. of the Philippines Baguio	Baguio	Filipino
32	Turgut AK	M	akturgut@yahoo.com	PhD. Student	Yalova Univesity	Yalova	Turkish
33	Andrej Novak	M	andrej.novak@yahoo.com	PhD. Student	University of Zagreb	Zagreb	Kroasia
34	Chan Lay Guat	F	layguatc@sunway.edu.my	Student	Sunway University	Malaka	Malaysia
35	Tan Wai Kiat	M	wk.tan@outlook.com	PhD. Student	Universiti Sains Malaysia	Malaysia	Malaysia
36	Lim Yong Hui	F	genylimyh@gmail.com	Student	Universiti Sains Malaysia	Malaysia	Malaysia
37	Kh'ng Xin Yi	F	khng.xinyi@gmail.com	Student	Universiti Sains Malaysia	Malaysia	Malaysia

## School Programs

The programs are summarized as follows

1. Course: The Variational Partial Differential Equations  
Instructor: Prof. Dr. Marian P Roque  
Objective: To introduce some variational partial differential equations.  
Discussion starts with some basic notions in Functional Analysis, and followed with variational formulation of several partial differential equations. Natural boundary conditions were also discussed.
2. Course: Finite Difference Scheme for Shallow Water Equations (SWE)  
Instructor: Prof. Dr. Sri Redjeki P.  
Objective: To introduce the staggered finite difference scheme for SWE  
Starting from the Euler equations for inviscid fluid, under the assumption of horizontally dominant flow, the shallow water equations were derived. Then staggered scheme was discussed and implemented to simulate standing wave. Dispersion relation of these wave models were also discussed.
3. Course: Variational structure behind Hawassi software  
Instructor: Prof. Brenny van Groesen  
Objective: To explain the variational formulation behind Hawassi.  
Hawassi is an open source software for simulation various ocean waves phenomena. Basically there are two models, variational Boussinesq model (VBM) and analytical Boussinesq (AB) model. Variational structure behind these models were discussed during the school. Dimensional analysis applied to wave problem was also discussed.
4. Course: The Basic FEM and VBM method in Hawassi  
Instructor: Dr. Didit Adytia  
Objective: The programming FEM was introduced.  
Starting from the basic ode with boundary conditions, participants were guided to implement the one dimensional Finite Element Method. Discussion was extended to solve the one dimensional SWE, and further to solve Boussinesq equations. Short explanation on software Hawassi was given.
5. Course: Mathematical Models for some free surface flows  
Instructor: Prof. Dr. Leo H. Wiryanto  
Objective: To find solution of Boussinesq equations, steady and unsteady.  
Starting with mass and momentum conservation, using potential function formulation the model is simplified to Boussinesq type of equations. Steady and unsteady solution of this equation were computed during project session.
6. Course: Finite Volume Method for SWE  
Instructor: Dr. Sudi Mungkasi  
Objective: To study and implement the Finite Volume Method (FVM) for solving Partial Differential Equations.  
Starting with an overview of finite volume method, participants were guided to solve convective equation. Further, participants were requested to implement the finite volume scheme to solve one dimensional Shallow Water Equations, and also two dimensional Shallow Water Equations.

**MATHEMATICAL AND NUMERICAL MODELLING FOR WAVE DYNAMICS, 1-9 JUNE 2016**

**INSTITUT TEKNOLOGI BANDUNG, INDONESIA**

**PROGRAMME**

HOUR	WED 1-6-'16	THURS 2-6-'16	FRI 3-6-'16	SAT 4-6-'16	SUN 5-6-'16	MON 6-6-'16	TUE 7-6-'16	WED 8-6-'16	THURS 9-6-'16	
8.00-8.15	OPENING				E X C U R S I O N					
8.15-10.00	SRI R	MARIAN	DIDIT	LEO		SRI R	SUDI	SUDI	PROJECT SEMINAR	
			15 MIN BREAK							
10.00-10.30	COFFEE BREAK	COFFEE BREAK	DIDIT LAB SESSION	COFFEE BREAK			COFFEE BREAK	COFFEE BREAK	COFFEE BREAK	COFFEE BREAK
10.30-12.15	MARIAN	MARIAN LAB SESSION	11.15- 13.15	LEO LAB SESSION			LEO	SUDI LAB SESSION	SUDI LAB SESSION	GUEST LECTURES
12.15-13.15	LUNCH BREAK	LUNCH BREAK	PRAY & LUNCH BREAK	LUNCH BREAK			LUNCH BREAK	LUNCH BREAK	LUNCH BREAK	LUNCH & CLOSING
13.15-15.00	MARIAN	BRENNY	BRENNY	DIDIT			LEO LAB SESSION	PROJECT*	PROJECT*	CITY TOUR OPTIONS: A. SHOOPING, B. STREET GOURMET
15.00-15.30	COFFEE BREAK	COFFEE BREAK	COFFEE BREAK	COFFEE BREAK			COFFEE BREAK	COFFEE BREAK	COFFEE BREAK	
15.30-17.00	SRI R LAB SESSION	BRENNY	BRENNY LAB SESSION	DIDIT LAB SESSION				PROJECT*	PROJECT*	
		DINNER AT LABMATH INDONESIA, BRENNY'S INVITATION						BUKA PUASA DINNER		

## 5. Conclusion

The SEAMS School went very smoothly. Participants were enthusiastic in following the course. Almost all participants were willing to work on the exercises during lab sessions, including the projects. But by the end of the course, few participants got ill, this is possibly because of tight schedule of the SEAMS School in combination with fasting period. Due to fasting period that has started from June 6<sup>th</sup>, 2016, and about three-quarter of the participants were Muslim, we adjust the schedule a little bit. The first day of the fasting period, the school was dismissed at 15.00. On the second and third days, the school were dismissed at 16.00. We think this adjustment were really necessary, besides we started early at 8.15 every day. The last day also went smoothly. In the morning session, participants were presenting their results of the projects, and the last session was guest lecturer session. From these somewhat general seminars, participants will be able to gain a broader view of the subject.

## 6. Financial Report

See the next page

Grand total source	IDR 127.340.000,00
Grand total expenses	IDR 127.072.562,32
Saldo	IDR 267.437,68

## Financial Report

Item	Debit (IDR)	Credit (IDR)	Total (IDR)
<b>Source</b>			
CIMPA	75,140,000.00		
FMIPA ITB (Fac. of Math. & Natural Sciences)	10,000,000.00		
KK MIK (Industrial & Financial Math. Research Group)	4,000,000.00		
EFFRaCC research grant, British Council	20,000,000.00		
Labmath Indonesia provide us a Welcome Dinner on June 2nd, 2016			
MSA fund, Mathematics ITB	5,000,000.00		
ITB Research grant	10,000,000.00		
Registration fee (non support participants)	3,200,000.00		
<b>Total Source</b>			<b>127,340,000.00</b>
<b>Expenses covered by CIMPA</b>			
Return travel fares of 10 participants (5 Indonesian, 2 Philippines, 3 Malaysian) and 2 lecturers (Marian, Sudi)		30,002,472.32	
10 days accomodations for 13 participants		36,260,000.00	
Accomodation for lecturers (Marian, Sudi)		5,805,842.00	
Dinner for overseas Speaker		697,730.00	
Conference kit		2,706,000.00	
<b>Total expenses covered by CIMPA</b>			<b>75,472,044.32</b>
<b>Expenses covered by FMIPA &amp; KK MIK</b>			
Lunches during SEAMS School		9,741,000.00	
Coffee breaks during SEAMS School		4,942,500.00	
<b>Total expenses covered by FMIPA &amp; KK MIK</b>			<b>14,683,500.00</b>
<b>Expenses covered by EFFRaCC Reseach grant</b>			
Travel support for participant from Turki		8,957,000.00	
Travel support for participant from Kroasia		8,759,000.00	
Travel support for participant from Makassar		1,500,000.00	
JNE expedition		184,000.00	
Office boy & administration		600,000.00	
<b>Total expenses covered by EFFRaCC Reseach grant</b>			<b>20,000,000.00</b>
<b>Expenses covered by MSA, ITB research grant, registration fee</b>			
Buka Puasa Dinner for participants		3,031,018.00	
Excursions for participants		11,120,500.00	
Souvenirs for Lecturers and Guest Lecturers		2,185,500.00	
Pasang spanduk		80,000.00	
Documentation		500,000.00	
<b>Total expenses covered by MSA, Riset KK ITB, registration fee</b>			<b>16,917,018.00</b>



## 7. Photos



Photo 1: The first group photo of participants and lecturer, on the first day June 1, 2016, after the opening session.



Photo 2: Lecturers from left to right: Dr. Didit Adytia, Prof. Leo H.W., Prof. Sri R. P. Prof. Marian P.R. together with dean of the Faculty of Mathematics and Natural Sciences, ITB (Prof. Edy T. Baskoro).



Photo 3: Lecture sessions of Prof. Marian P. Roque and Prof. Leo H Wiryanto. Delivering a souvenir to Prof. Brenny van Groesen, after his session completed.



Photo 4: In the classroom after Marian session.



Photo 5: Another group photo of participants, lecturers, and guest lecturers, taken on the last day June 9, 2016.