

SOUTH EAST ASIAN MATHEMATICAL SOCIETY

FINAL REPORT

SEAMS SCHOOL 2015: Modelling and Simulation for the Environmental Phenomena

**Yogyakarta, Indonesia
7-15 September 2015**

**Organized by
Sanata Dharma University**

with the support of

- **CIMPA (Centre International de Mathématiques Pures et Appliquées)**
- **ANU (Australian National University) Indonesia Project**
- **SMERU Research Institute**
- **LPPM (Institute for Research and Community Services), Sanata Dharma University**
- **Department of Mathematics, Sanata Dharma University**

2015

FINAL REPORT
SEAMS SCHOOL 2015: Modelling and Simulation
for the Environmental Phenomena
Sanata Dharma University, Yogyakarta, Indonesia, 7-15 September 2015

1. Summary

This SEAMS School focused on mathematical modelling and numerical simulation relating to environmental phenomena, such as flood, tsunami, rain, weather, climate, etc. We considered finite difference, finite volume, boundary element, and spectral methods for the numerical techniques. Several free packages were used. ANUGA was used in simulations of floods and tsunamis. SPHEREPACK was used in weather simulations. After attending this School, participants were expected to have skills on deriving mathematical models for those phenomena as well as solving the models using the considered numerical techniques.

2. Scientific Objectives and Rationale for the School

The main objective of the School is to give enough overview for participants from Indonesia and neighbouring countries to do research, especially on mathematical modelling and numerical simulation for the environmental phenomena. This is considered important, because South East Asian countries, such as Indonesia, have very dynamic environmental phenomena including regions which are prone to natural disasters (flood, tsunami, etc.). More specific objectives are explained in Section 5.

3. Organizers and Instructors

Three members of the organizing committee are as follows.

1. Name : **Dr. Sudi Mungkasi**
Institution : Department of Mathematics,
Sanata Dharma University, Yogyakarta, Indonesia
Email : sudi@usd.ac.id

2. Name : **Prof. Dr. Leo Hari Wiryanto**
Institution : Department of Mathematics,
Bandung Institute of Technology, Bandung, Indonesia
Email : leo@math.itb.ac.id

3. Name : **Drs. Agah Drajat Garnadi, Grad.Dipl.Sc.**
Institution : Department of Mathematics,
Bogor Agricultural University, Bogor, Indonesia
Email : agah.garnadi@gmail.com

Seven instructors in the School are as follows.

1. Name : **Prof. Dr. Leo Hari Wiryanto**
 Institution : Department of Mathematics,
 Bandung Institute of Technology, Bandung, Indonesia
 Email : leo@math.itb.ac.id
2. Name : **Dr. Imam Solekhu**
 Institution : Department of Mathematics,
 Gadjah Mada University, Yogyakarta, Indonesia
 Email : imams@ugm.ac.id
3. Name : **Prof. Dr. Stephen Roberts**
 Institution : Mathematical Sciences Institute,
 Australian National University, Canberra, Australia
 Email : stephen.roberts@anu.edu.au
4. Name : **Drs. Agah Drajat Garnadi, Grad.Dipl.Sc.**
 Institution : Department of Mathematics,
 Bogor Agricultural University, Bogor, Indonesia
 Email : agah.garnadi@gmail.com
5. Name : **Dr. Tri Wahyu Hadi**
 Institution : Department of Meteorology,
 Bandung Institute of Technology, Bandung, Indonesia
 Email : tri@meteo.itb.ac.id
6. Name : **Prof. Dr. Sri Redjeki Pudjaprasetya**
 Institution : Department of Mathematics,
 Bandung Institute of Technology, Bandung, Indonesia
 Email : sr_pudjap@math.itb.ac.id
7. Name : **Dr. Sudi Mungkasi**
 Institution : Department of Mathematics,
 Sanata Dharma University, Yogyakarta, Indonesia
 Email : sudi@usd.ac.id

4. Participants

In this SEAMS School we had 38 participants consisting of 12 non-Indonesians and 26 Indonesians. Among all 38 participants attending the School, 20 participants are males and 18 participants are female.

Note that actually we accepted 40 participants consisting of 12 non-Indonesians and 28 Indonesians. However, two Indonesian participants did not attend the School due to their urgent matters.

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

NO.	NAME OF PARTICIPANT	COUNTRY
1	MR. CHENTRA PEN	CAMBODIA
2	MR. SOKKHEY PHAUK	CAMBODIA
3	MS. NUR IZZATI BINTI KHAIRUDIN	MALAYSIA
4	MS. NUR SHAFIKA ABEL BINTI RAZALI	MALAYSIA

5	MR. ALLEN LAMARCA NAZARENO	PHILIPPINES
6	MS. DESTINY S. LUTERO	PHILIPPINES
7	MS. DIANE CARMELIZA N. CUARESMA	PHILIPPINES
8	MR. JULIUS FERGY T. RABAGO	PHILIPPINES
9	MR. MARK LEXTER D. DE LARA	PHILIPPINES
10	MR. ROMMEL REAL	PHILIPPINES
11	MS. SHARON PAZ LUBAG	PHILIPPINES
12	MS. CHI DAO KIM	VIETNAM
13	MS. ANASTASIA DEVINA OKTAVIANI	INDONESIA
14	MR. ANTONIUS YUDHI ANGGORO	INDONESIA
15	MR. ALEXANDER AGUNG S. GUNAWAN	INDONESIA
16	MR. BENI UTOMO	INDONESIA
17	MR. BUDDIN AL HAKIM	INDONESIA
18	MR. DIMAS AVIAN MAULANA	INDONESIA
19	MS. DWI LESTARI	INDONESIA
20	MR. EDWIN SETIAWAN NUGRAHA	INDONESIA
21	MS. EMINUGROHO RATNA SARI	INDONESIA
22	MR. FEBI SANJAYA	INDONESIA
23	MR. FIRDAUS	INDONESIA
24	MS. FITRIANA YULI SAPTANINGTYAS	INDONESIA
25	MS. GIRI IRIANI JAYA NINGRUM	INDONESIA
26	MR. HUGO PROBO GUMELAR	INDONESIA
27	MR. IKHSAN MAULIDI	INDONESIA
28	MS. ILGA PURNAMA SARI	INDONESIA
29	MS. INNA SYAFARINA	INDONESIA
30	MS. INTAN NUR TUNGGADAWI	INDONESIA
31	MS. LUSIA KRISMIYATI BUDIASIH	INDONESIA
32	MS. NIKENASIH BINATARI	INDONESIA
33	MR. NORMAN LEWIS SIBORO	INDONESIA
34	MR. RIFKY FAUZI	INDONESIA
35	MR. SUGIYANTO	INDONESIA
36	MR. SURYA, JOSHUA AUDREY	INDONESIA
37	MS. VERA HALFIANI	INDONESIA
38	MS. VINA APRILIANI	INDONESIA

5. School Programs

The programs are summarized as follows.

COURSES

[1]. Course: Mathematical models for some free surface flows

Instructor: Prof. Dr. Leo Hari Wiryanto

Objective: To introduce some fluid problems involving free surface

Abstract: Mathematical models for free surface flows are derived using some potential functions, and solved numerically by boundary element method. Some mathematical theories of complex function and transformation are used so that the models become an integral equation that can be solved by the method.

[2]. Course: Python programming

Instructor: Drs. Agah Drajat Garnadi, Grad.Dipl.Sc.

Objective: To use Python as a free and open source language in programming

Abstract: The programming language Python is introduced. This language is chosen as it is free and open source, so users do not need to buy any license. We start this Python course with simple examples and practices, and continue to more advanced programming. This course will support numerical experiments and simulations to solve mathematical models.

[3]. Course: Finite volume methods

Instructor: Dr. Sudi Mungkasi

Objective: To solve conservation laws numerically

Abstract: Mathematical models in the form of conservation laws are solved using finite volume methods. In particular we are interested in the shallow water equations, as they govern shallow water flows. Numerical experiments will be executed using Python programming language.

[4]. Course: ANUGA software

Instructor: Prof. Dr. Stephen Roberts

Objective: To introduce ANUGA software to simulate shallow water flows

Abstract: ANUGA is a free and open source software, written based on Python. It is a package that solves the shallow water equations using a finite volume method. Participants are expected to be able to simulate flood and tsunami using ANUGA.

[5]. Course: Modelling and simulation for weather

Instructor: Dr. Tri Wahyu Hadi

Objective: To introduce mathematical models for weather

Abstract: Weather models and spectral method are introduced. The barotropic vorticity model is the first and simplest weather model solved by modern computer. We will show how spectral barotropic vorticity model is implemented for weather prediction over the entire globe. Complicated spherical harmonic computation is carried out using free SPHEREPACK software package.

[6]. Course: Finite difference methods

Instructor: Prof. Dr. Sri Redjeki Pudjaprasetya

Objective: To solve mathematical models numerically

Abstract: Finite difference methods are used to solve mathematical models. These methods have advantages as their structures are simple. Therefore programming will not be tedious. This course will complement the finite volume course in this SEAMS School. Of course we also include numerical experiments on solving mathematical models using finite difference methods.

[7]. Course: Boundary elements methods

Instructor: Dr. Imam Solekudin

Objective: To solve mathematical models numerically

Abstract: In this lecture, a boundary element method is applied to solve problems involving Laplace equations numerically. A derivation of the method is presented. Using the method, the problems can be reduced into systems of linear algebraic equations, which may be solved to obtain numerical solutions. These numerical solutions are then used to obtain numerical solution at any points in the domain and boundary of the problems. The method is implemented with MATLAB, and tested using two examples.

Schedule

The schedule is written in the table below: 7-15 September 2015. The names here correspond to the first names of the instructors. Note that in addition to the seven instructors, by invitation, Prof. Dr. Lutz Gross (School of Earth Sciences, The University of Queensland, Australia) also gave lectures on geophysical modelling and simulations.

TIME	MON, 7 SEP 2015	TUE, 8 SEP 2015	WED, 9 SEP 2015	THU, 10 SEP 2015	FRI, 11 SEP 2015	SAT, 12 SEP 2015	SUN, 13 SEP 2015	MON, 14 SEP 2015	TUE, 15 SEP 2015
08:45-09:00	MORNING TEA	MORNING TEA	MORNING TEA	MORNING TEA	EXCURSION	MORNING TEA	FREE TIME	MORNING TEA	MORNING TEA
09:00-10:00	AGAH	SRI	LEO	TRI		IMAM		LUTZ	SUDI
10:00-11:00	AGAH	SRI	LEO	TRI		IMAM		LUTZ	DISCUSSION / PROJECT
11:00-12:00	AGAH	SRI	LEO	TRI		IMAM		STEPHEN	DISCUSSION / PRESENTATION
12:00-13:00	LUNCH BREAK	LUNCH BREAK	LUNCH BREAK	LUNCH BREAK		LUNCH BREAK		LUNCH BREAK	CLOSING & LUNCH
13:00-14:00	LEO	AGAH	TRI	SUDI		STEPHEN		STEPHEN	
14:00-15:00	LEO	AGAH	TRI	SUDI		STEPHEN		DISCUSSION / PROJECT	
15:00-15:30	COFFEE BREAK	COFFEE BREAK	COFFEE BREAK	COFFEE BREAK		COFFEE BREAK		COFFEE BREAK	
15:30-16:30	SRI	SUDI	DISCUSSION / PROJECT	DISCUSSION / PROJECT		STEPHEN		DISCUSSION / PROJECT	
16:30-17:30	SRI	SUDI	DISCUSSION / PROJECT	DISCUSSION / PROJECT		DISCUSSION / PROJECT		DISCUSSION / PROJECT	

6. Conclusion

There were minor changes in the implementation of our SEAMS School proposal. For example, Prof. Dr. Markus Hegland was replaced by Dr. Imam Solekudin, because Prof. Hegland had a schedule clash with his other important commitment. Another example is that we accepted 40 participants as expected, but on the days of the School two of them did not attend due to their urgent matters. However, these minor changes did not interfere the whole SEAMS School activities.

Overall, we have successfully conducted the SEAMS School. The schedule was fulfilled. The course objectives were satisfied. We had gender balance in terms of participants. The budget was met. With the courses delivered in this SEAMS School, participants should now have enough overview to do research for their further studies, especially on mathematical modelling and numerical simulation for the environmental phenomena.

7. Financial Report

(See the next six pages.)

Summary of Financial Report

SOURCE

Item	Debit	Credit	Total (Rupiah)	Note
CIMPA	IDR 70,285,289.00			€ 5,000.00
ANU and SMERU	IDR 67,661,868.58			
LPPM (Institute for Research and Community Services) Sanata Dharma University	IDR 15,000,000.00			
Department of Mathematics Sanata Dharma University	IDR 10,000,000.00			
Registration fee (non support participants)	IDR 5,000,000.00			
Total Source			IDR 167,947,157.58	
EXPENSES covered by CIMPA				
Return travel fares of 10 non-Indonesian Participants (2 Cambodia, 1 Vietnam, 2 Malaysia, 5 Philippines)		IDR 38,056,000.00		
10 days accommodation for 11-non Indonesian Participant (Wisma La Kusuma)		IDR 18,000,000.00		
Daily transportation for overseas participants (2 car rental for 10 days)		IDR 8,000,000.00		
SEAMS School welcome dinner		IDR 5,582,500.00		
Dinner for overseas Speaker		IDR 607,200.00		
Total Expenses			IDR 70,245,700.00	€ 4,997.18
EXPENSES covered by ANU and SMERU				
Return travel fares of 7 Indonesian Participants		IDR 8,423,000.00		
9 days accommodation for 11 Indonesian Participant (Wisma La Kusuma)		IDR 16,500,000.00		
Lunch during SEAMS School		IDR 22,050,000.00		
Excursion for 15 Indonesian participant (tickets and parking charges)		IDR 515,000.00		
Accommodation for Indonesian speaker (Jogja Plaza Hotel)		IDR 6,450,000.00		
Excursion for overseas participant and speaker (11 participants and 2 speaker)		IDR 3,250,000.00		
Return travel fares for 1 Indonesian speakers (+ assistance)		IDR 440,000.00		
Snack during SEAMS School		IDR 7,350,000.00		
External hard disk		IDR 2,548,000.00		
expedition via JNE		IDR 100,000.00		
Total Expenses			IDR 67,626,000.00	
EXPENSES covered by LPPM Sanata Dharma University				
Documentation (photo and video)		IDR 3,700,000.00		
Return travel fares for 3 Indonesian speakers		IDR 3,714,000.00		
Return travel fares of 2 Indonesian Participants		IDR 804,000.00		
Stationery and Committee Expenses (double tip, stempel, cartridge, glue, papers, communication)		IDR 2,402,000.00		
Souvenir for SEAMS School Speakers (Batik)		IDR 3,347,000.00		
Excursion for Overseas Speaker		IDR 1,019,000.00		
Total Expenses			IDR 14,986,000.00	
EXPENSES covered by Registration fee				
Flash disk for SEAMS School Participants		IDR 5,000,000.00		
Total Expenses			IDR 5,000,000.00	
EXPENSES covered by Department of Mathematics Sanata Dharma University				
Stationery and Committee Expenses (envelope, snack for meeting, communication, transportation)		IDR 4,655,900.00		
Bus rental for excursion and welcome dinner		IDR 4,500,000.00		
Total Expenses			IDR 9,155,900.00	

Grand Total Source IDR 167,947,157.58

Grand Total Expenses IDR 167,013,600.00

Saldo IDR 933,557.58

EXPENSES covered by CIMPA

1	Return travel fares of 10 non-Indonesian Participants (2 Cambodia, 1 Vietnam, 2 Malaysia, 5 Philippines)		
	Details	Amount	Proof Number
	Ticket for Chentra PEN	IDR 4,000,000.00	11.1
	Ticket for Sökkhey Phauk	IDR 4,000,000.00	11.2
	Ticket for Nur Izzati Binti Khairudin	IDR 1,800,000.00	11.3
	Ticket for Nur Shafika Abel Binti Razali	IDR 2,499,000.00	11.4
	Ticket for Julius Fergy T. Rabago	IDR 5,000,000.00	11.5
	Ticket for Sharon Paz Lubag	IDR 4,199,000.00	11.6
	Ticket for Rommel Real	IDR 4,413,000.00	11.7
	Ticket for Diane Carmeliza N Cuaresma	IDR 3,707,000.00	11.8
	Ticket for Mark Lexter D. De Lara	IDR 4,370,000.00	11.9
	Ticket for Chi Dao Kim	IDR 4,068,000.00	11.10
	Total	IDR 38,056,000.00	
2	10 days accommodation for 11-non Indonesian Participant (Wisma La Kusuma)	IDR 18,000,000.00	12.1
3	Daily transportation for overseas participants (2 car rental for 10 days)	IDR 8,000,000.00	13.1
4	SEAMS School welcome dinner	IDR 5,582,500.00	14.1
5	Dinner for overseas Speaker	IDR 607,200.00	15.1

EXPENSES covered by ANU and SMERU

1	Return travel fares of 7 Indonesian Participants		
	Details	Amount	Proof Number
	Ticket for Vera Halfiani (Aceh)	IDR 4,100,000.00	16.1
	Ticket for Edwin Setiawan Nugraha	IDR 360,000.00	16.2
	Ticket for Rifky Fauzi	IDR 495,000.00	16.3
	Ticket for Inna Syafarina	IDR 655,000.00	16.4
	Ticket for Ikhsan Maulidi	IDR 1,273,000.00	16.5
	Ticket for Vina Apriliani	IDR 1,273,000.00	16.6
	Ticket for Intan Nur Tunggadewi	IDR 267,000.00	16.7
	Total	IDR 8,423,000.00	
2	9 days accommodation for 11 Indonesian Participant (Wisma La Kusuma)	IDR 16,500,000.00	17.1
3	Lunch during SEAMS School	IDR 22,050,000.00	18.1
4	Excursion for 15 Indonesian participant (tickets and parking charges)		
	Borobudur Tickets	IDR 450,000.00	19.1
	Parking Charges 1	IDR 50,000.00	19.1
	Parking Charges 2	IDR 15,000.00	19.1
	Total	IDR 515,000.00	
5	Accommodation for Indonesian speaker (Jogja Plaza Hotel)		
	Accommodation for Prof Leo	IDR 500,000.00	20.1
	Accommodation for Eka Budiarto	IDR 500,000.00	20.1
	Accommodation for Faiz Rohman	IDR 3,450,000.00	20.1
	Accommodation for Prof Sri Redjeki	IDR 1,000,000.00	20.1
	Accommodation for Prof Leo	IDR 1,000,000.00	20.1
	Total	IDR 6,450,000.00	
6	Excursion for overseas participant and speaker (11 participants and 2 speaker)	IDR 3,250,000.00	21.1
7	Return travel fares for 1 Indonesian speakers (+ assistance)		
	Transportation for Imam S, Ph.D	IDR 400,000.00	1.1
	Taxi for Faiz Rohman	IDR 40,000.00	1.1
	Total	IDR 440,000.00	
8	Snack during SEAMS School	IDR 7,350,000.00	2.1
9	External hard disk	IDR 2,548,000.00	24.1
10	Expedition via JNE		
	Expedition via JNE 1	IDR 28,000.00	25.1
	Expedition via JNE 2	IDR 72,000.00	25.1
	Total	IDR 100,000.00	

EXPENSES covered by LPPM Sanata Dharma University

	Details	Amount	Proof Number
1	Documentation (photo and video)	IDR 3,700,000.00	3.1
2	Return travel fares for 3 Indonesian speakers		
	Tickets for Drs. Agah Garnadi	IDR 1,133,000.00	4.1
	Tickets for Prof Sri Redjeki	IDR 1,203,000.00	4.1
	Tickets for Prof Leo	IDR 1,378,000.00	4.1
	Total	IDR 3,714,000.00	
3	Return travel fares of 2 Indonesian Participants		
	Ticket for Buddin Al Hakim	IDR 536,000.00	5.1
	Ticket for Anastasia Devina Oktaviani	IDR 268,000.00	5.2
	Total	IDR 804,000.00	
4	Stationery and Committee Expenses (double tip, stempel, cartridge, glue, papers, communication)		
	Stationery 1	IDR 250,900.00	6.1
	Photocopy 1	IDR 171,300.00	6.1
	Photocopy 2	IDR 153,000.00	6.1
	Communication	IDR 150,000.00	6.1
	Ink refill	IDR 498,000.00	6.1
	Cartridge	IDR 467,000.00	6.1
	Name Text	IDR 67,500.00	6.1
	Stempel	IDR 120,000.00	6.1
	Stationery 2	IDR 388,200.00	6.1
	Stationery 3	IDR 136,100.00	6.1
	Total	IDR 2,402,000.00	
5	Souvenir for SEAMS School Speakers (Batik)	IDR 3,347,000.00	22.1
6	Excursion for Overseas Speaker	IDR 1,019,000.00	8.1

EXPENSES covered by Registration fee

	Details	Amount	Proof Number
1	Flash disk for SEAMS School Participants	IDR 5,000,000.00	9.1

EXPENSES covered by Department of Mathematics Sanata Dharma University

	Details	Amount	Proof Number
1	Stationery and Committee Expenses (envelope, snack for meeting, communication, transportation)	IDR 4,655,900.00	23.1
2	Bus rental for excursion and welcome dinner	IDR 4,500,000.00	10.1

8. Photos

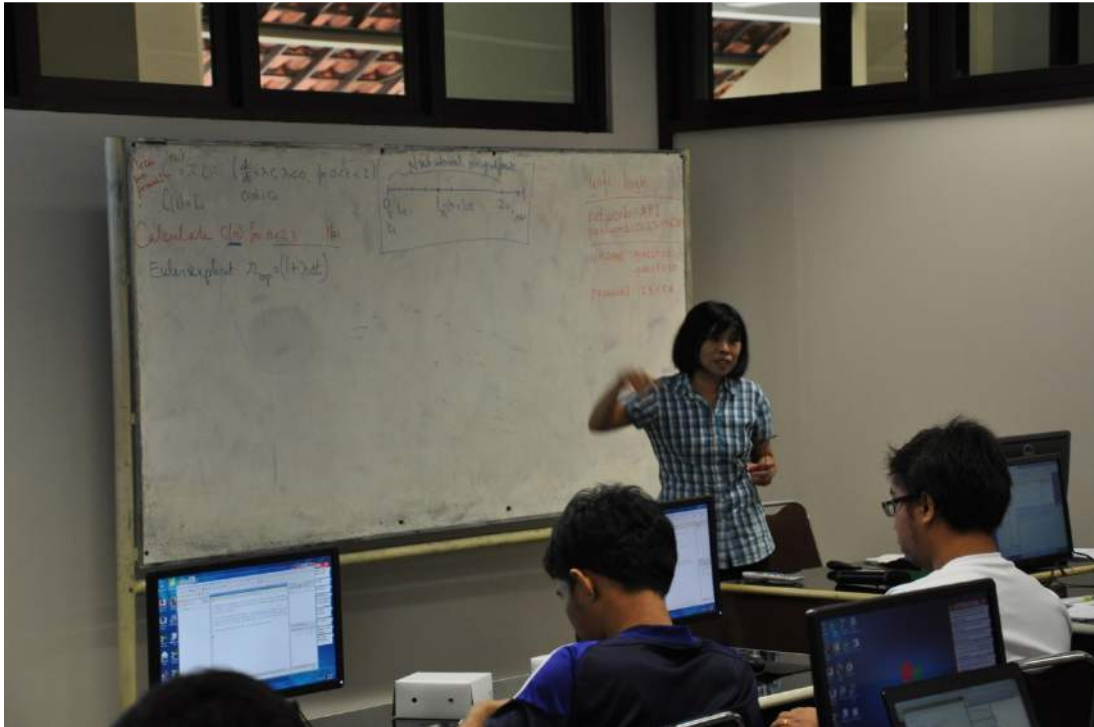
Here we provide six pictures to show activities of the School.



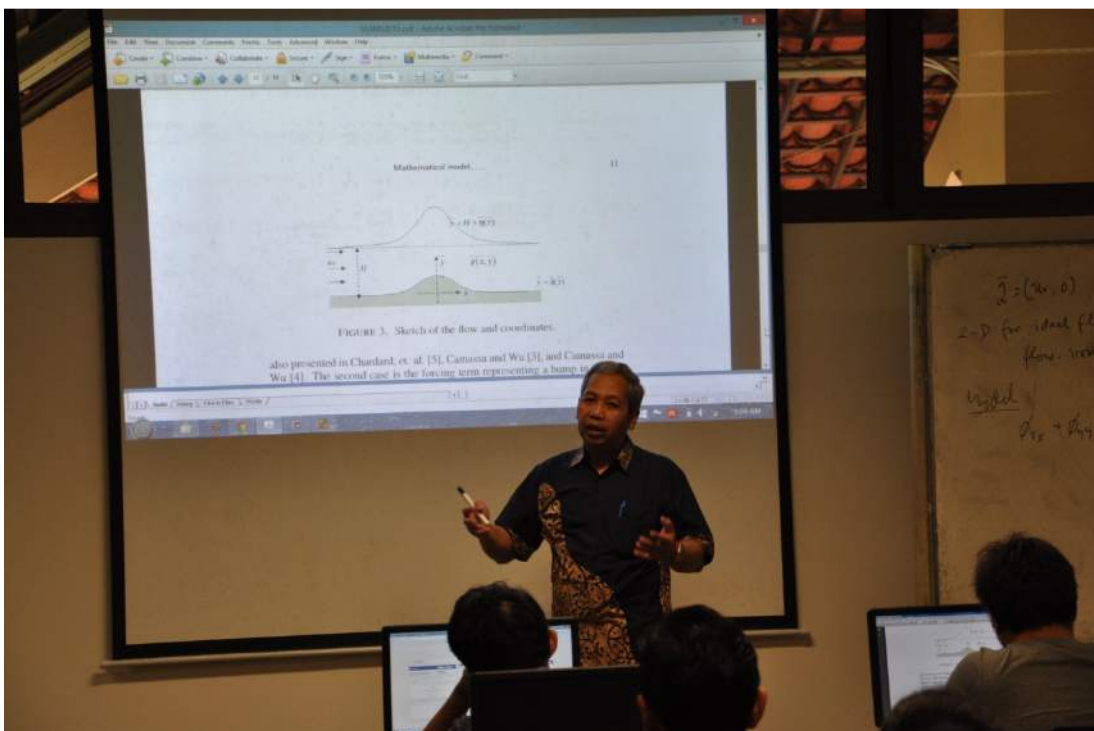
Picture 1. A theoretical session of the School.



Picture 2. A practical session of the School.



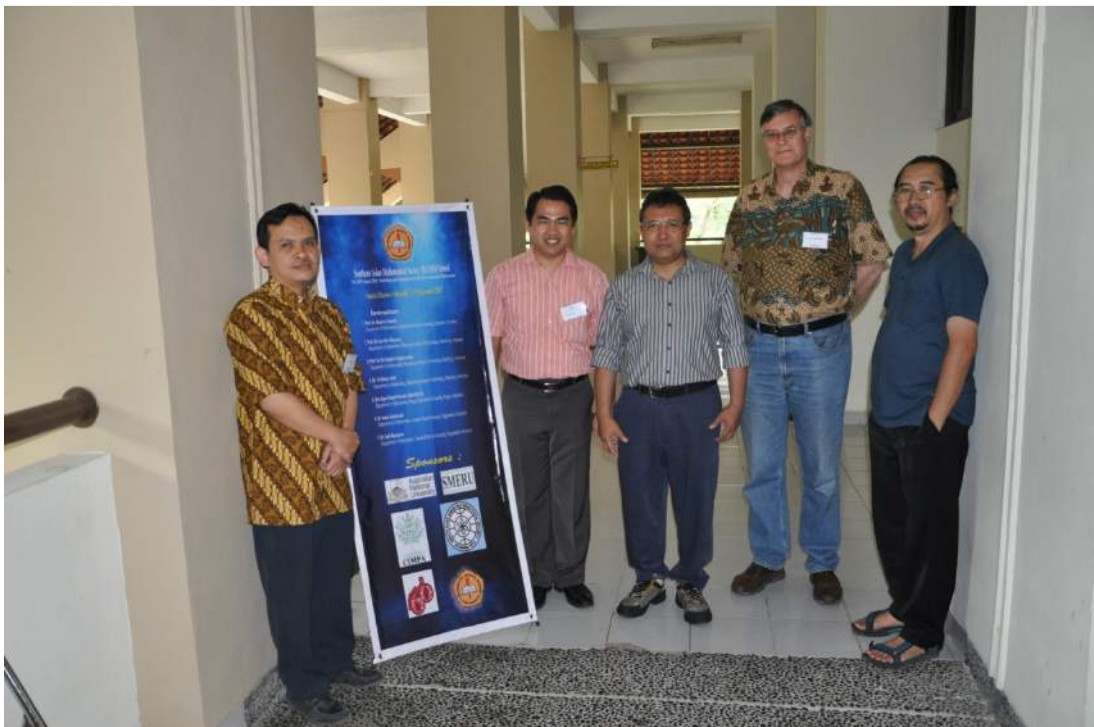
Picture 3. Professor Sri Redjeki Pudjaprasetya delivering the course.



Picture 4. Professor Leo Hari Wiryanto delivering the course.



Picture 5. A photo session next to the lecture room.



Picture 6. Some of the School instructors. From left to right:
(1). Dr. Imam Solekhudin, (2). Dr. Sudi Mungkasi, (3). Dr. Tri Wahyu Hadi,
(4). Prof. Stephen Roberts, and (5). Drs. Agah Drajat Garnadi, Grad.Dipl.Sc.