

CIMPA School Final Report

Title of the school: MATHEMATICAL MODELS IN BIOLOGY AND RELATED APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Dates: 11 June - 21 June 2019

Location: University of Havana, Cuba

I. Summary

Mathematical modeling in biology and related domain is becoming of increasing importance in the mathematical community as well as for the other scientists from the point of view of possible applications. The school aimed at presenting some of the current approaches in PDE modeling and mathematical analysis of biological phenomena or related domains. It aimed at allowing the researchers and the postgraduate students to acquire a basic training in that field and to have an overview of what is the current research status of these types of problems.

The school covered a wide class of models and applications in biology, epidemiology and neurosciences. The main mathematical methods concerned the study of evolutionary partial differential equations, such as their large time behavior, their links with stochastic models, as well as numerical methods to approximate their solutions.

The lecture activities of this CIMPA School started in June 11TH at the Faculty of Mathematics and Computer Science in Havana University. The Organizing and Scientific Committee devoted a great effort to the development of the School, they not only spent long time in the conception and organization of the School, they also contributed recruiting complementary funds to those previously offered by CIMPA.

During the School, were given conditions providing a wide interchange between participants, speakers and lecturers. Five courses and eighteen talks were given from people of different institutions. The high scientific level of the courses and presentations was celebrated by most of participants. The assistance to lectures and talks was excellent. The motivation was high. The professors have attended also the courses by their colleagues. Mostly of the lecturers and speakers gave notes or presentations, which were deposited in a PC, accessible to all participants.

Were organized for the first time 7 training sessions for young participants.

The total amount of participants has been 63 (5 lecturers, 19 invited speakers, 34 students, 4 organizers and 1 CIMPA officer); among them, 23 were women. Six participants were from Latin-American countries (Mexico (1), Argentina (2), Colombia (1) and Peru (2)). They were supported (totally) by the CIMPA funds.

All the participants and speakers had lunch together every day at “La Roca” Restaurant. Fifteen Cuban participants were supported (lunch) from CIMPA, in order that all participants and speakers were together at lunch. The coffee breaks in the morning and in the afternoon were of 15 minutes and the daily activities finished at 5:00 pm.

Most of foreign participants and lecturers were accommodated in Vedado Hotel. This unity of place was very favorable to the course of the School, contacts and exchanges took great advantage of this.

The host institution for the School provided an excellent environment and ensured that all required infrastructure was in place. The lecture room was just large enough to accommodate

all the participants. The classroom had a good equipment (PC and canyon) and correct conditions (illumination and climate were acceptable). Was implemented a wifi network for participants. The organizers and some participants were interviewed for a radio program of the chain HAVANA RADIO.

This School has been very useful in order to stimulate research in the region. The program was well-planned and permitted all participants to attend all the courses, talks and interact between them. The relationships among researchers became stronger after the school; the contacts made at this event will be highly beneficial to the career development of the participants.

Several social activities were coordinated by the Organizing Committee as follows: welcome and farewell cocktails, a guided visit to Capitolio National, a dinner for speakers and different excursions on weekends. These activities provided ample opportunity for interaction among participants. Each week was taken an official photo of the School.

II. Scientific content

Final list of courses:

1. Traveling Fronts in Homogeneous and Heterogeneous Environments. Lecturer: Nancy Rodriguez-Bunn.
2. Mean-field Theory for Networks of Spiking Neurons. Lecturer: Alexander Roxin.
3. Modelling interacting networks as processes with variable length. Lecturer: Eva Locherbach.
4. Mathematical modelling of actin driven cellular morphodynamics and motility. Lecturer: Christian Schmeiser.
5. The many-particle limit and its mathematical analysis. Lecturer: Clément Mouhot.

Final list of talks:

1. Desarrollo de modelos computacionales en mecanobiología: aplicaciones a biología del desarrollo. Invited speaker: Diego A. Garzón.
2. Identifiability and stability analysis for infection-load structured epidemiological models. Invited speaker: Antoine Perasso.
3. PDE models for interacting agents. Invited speaker: Franca Hoffmann.
4. Coupling methods for PDEs. Invited speaker: Pierre Gabriel.
5. Genetic diversity in age-structured populations. Invited speaker: Jimmy Garnier.
6. A quantitative genetics model for sexual reproduction under the regime of small variance. Invited speaker: Florian Patout.
7. Mathematical modeling of the spread of Wolbachia for dengue control. Invited speaker: Nicolas Vauchelet.
8. Dynamics of neuroendocrine stress response. Invited speaker: Maria Rita D'Orsogna.
9. Nonlocal propagation in domain with obstacle. Invited speaker: Jerome Coville.
10. Long-time behaviour for Smoluchowski's coagulation equation. Invited speaker: Sebastian Throm.
11. Remarks on the blowing up of positive solutions to some semilinear diffusion equations. Invited speaker: Otared Kavian.
12. Hawkes processes as a spike train model. Invited speaker: Julien Chevallier.

13. PDE and pattern formation. Invited speaker: Faustino Sánchez Garduño.
14. Turing-Hopf patterns on dynamic surfaces. Invited speaker: Jorge A. Castillo,
15. Evolutionary dynamics for phenotypically structured populations in fluctuating environments. Invited speaker: Susely Figueroa.
16. Turing-Hopf instabilities in Keller-Segel model with glycolytic reaction. Invited speaker: Giani Egaña.
17. Quantitative regularity for parabolic De Giorgi classes. Invited speaker: Jessica Guerand.
18. Tumor growth and mechanical behaviour: coupling experimental data and mathematical models. Invited speaker: Jerome Fehrenbach.

III. Participants

N	Names	Institution	Country	Cat
1.	Christian Schmeiser	Universität Wien	Austria	CUR
2.	Eva Löcherbach	University of Cergy-Pontoise	France	CUR
3.	Alexander Roxin	Centre de Recerca Matemàtica	Spain	CUR
4.	Nancy Rodriguez-Bunn	University of North Carolina at Chapel Hill	USA	CUR
5.	Clément Mouhot	University of Cambridge	UK	CUR
6.	Claude Bardos	Université Paris 7	France	CONF
7.	Julien Chevallier	Université de Grenoble	France	CONF
8.	Pierre Gabriel	Université de Versailles Saint-Quentin	France	CONF
9.	Jimmy Garnier	CNRS - Chambéry	France	CONF
10.	Otared Kavian	Université de Versailles Saint-Quentin	France	CONF
11.	Maria Rita D'Orsogna	California State University	USA	CONF
12.	Antoine Perasso	Université de Besançon	France	CONF
13.	Sebastian Throm	Universidad de Granada	España	CONF
14.	Nicolas Vauchelet	Université Paris 13	France	CONF
15.	Jerome Coville	INRA Centre de Recherche PACA	France	CONF
16.	Faustino Sánchez-Garduño	Universidad Nacional Autónoma de México	México	CONF
17.	Jorge A. Castillo Medina	Universidad Autónoma de Guerrero	México	CONF
18.	Diego A. Garzón Alvarado	Universidad Nacional de Colombia	Colombia	CONF
19.	Susely Figueroa Iglesias	Université de Toulouse	Cuba	CONF
20.	Giani Egaña Fernández	Universidad de La Habana	Cuba	CONF
21.	Florian Patout	ENS Lyon	France	CONF
22.	Jessica Guerand	University of Cambridge	UK	CONF
23.	Franca Hoffmann	Caltech	Germany	CONF
24.	Jerome Fehrenbach	Université de Toulouse	France	CONF
25.	Ana Isis Toledo Marrero	Université Paris 7	Cuba	PAF
26.	Quentin Griette	Université de Bordeaux	France	PAF
27.	Ina Humpert	Uni Muenster	Germany	PAF
28.	Angeliki Menegaki	University of Cambridge	Greece	PAF
29.	Chuqi Cao	Paris-Dauphine University	China	PAF
30.	Laurent Lafleche	Paris-Dauphine University	France	PAF
31.	Michele Romanos	Université de Toulouse	France	PAF

32.	Marta Marulli	Universidad de Bologna, Universite Paris 13	Italia	PAF
33.	Océane Saincir	Université de Reims Champagne-Ardenne	France	PAF
34.	Laura Kanzler	University of Vienna	Austria	PAF
35.	Giulia Pilli	University of Vienna	Austria	PAF
36.	Michael Fischer	University of Vienna	Austria	PAF
37.	José Caluyna Pedro	Universidade Mandume Ya Ndemufayo	Angola	PAF
38.	Julio Cesar Valencia Guevara	Universidad Católica San Pablo	Perú	PF
39.	Neisser Pino Romero	Universidad Nacional Mayor San Marcos	Perú	PF
40.	Rocío Celeste Balderrama	Universidad de Buenos Aires-IMAS CONICET	Argentina	PF
41.	Fernando Saldaña García	Centro de Investigación en Matemáticas	México	PF
42.	Alvaro Almeida Gómez	Instituto Nacional de Matemática Pura y Aplicada	Brasil	PF
43.	Bruno Adolfo Buffa	Universidad Nacional de Córdoba-CONICET	Argentina	PF
44.	Alejandro Alfonso Rodriguez	Universidad de La Habana	Cuba	PAN
45.	Brenda Lambert Lamazares	ICIMAF	Cuba	PAN
46.	Enrique de Jesús Estrada Pato	Universidad de Oriente	Cuba	PAN
47.	Jessica Humara Fonseca	Neurociencias	Cuba	PAN
48.	José Enrique Alvarez Iglesias	Neurociencias	Cuba	PAN
49.	Richard Medina Rodríguez	Universidad de La Habana	Cuba	PAN
50.	Livan Ortiz Rosales	Universidad de Oriente	Cuba	PAN
51.	Eliany Garcia Pola	Universidad de La Habana	Cuba	PAN
52.	Suney Toste Regalado	Universidad de La Habana	Cuba	PAN
53.	Claudia Fonte Sánchez	Universidad de La Habana	Cuba	PAN
54.	Frank Ernesto Alvarez Borges	Universidad de La Habana	Cuba	PAN
55.	Jorly Alberto Pérez Pérez	Universidad Central de Las Villas	Cuba	PAN
56.	Jorge Estrada Hernández	Universidad de La Habana	Cuba	PAN
57.	Ania Mesa Rodríguez	Universidad de La Habana	Cuba	PAN
58.	Yanetsy Elisa Rodríguez León	Universidad de La Habana	Cuba	PAN
59.	José Alfredo Cañizo	Universidad de Granada	España	ORG
60.	Emeric Bouin	Paris-Dauphine University	France	ORG
61.	Mariano Rodríguez Ricard	Universidad de La Habana	Cuba	COL
62.	Valentina Badía Albanés	Universidad de La Habana	Cuba	COL
63.	Vlady Ravelomanana	CIMPA	France	RCT

Categories:

CUR= Lecturer

CONF=Invited speaker

ORG= Organizer

PAN= National Participant

PF= Participant supported by CIMPA

PAF=Self-funded participant

COL= Local Organizing Committee

RCT= CIMPA Scientific Officer