ACADEMIC REPORT

EMALCA EL SALVADOR 2018

UNIVERSIDAD GERARDO BARRIOS
SAN MIGUEL

Christian E. Schaerer & José Abraham Hernández
JULY 1 - 13, 2018

Contents

1 Introduction

The Mathematical Union of Latin America and the Caribbean (UMALCA) is an organization formed in agreement between mathematical societies of the region. Currently, it is made up of the national mathematical societies of Argentina, Brazil, Chile, Colombia, Cuba, Mexico, Peru, Uruguay, PARAGUAY and Venezuela. It was founded in July 1995, at a meeting held at the Institute of Pure and Applied Mathematics (IMPA) in Brazil.

The Mathematics Schools of Latin America and the Caribbean were created by decision of the Second General Assembly of the Mathematical Union of Latin America and the Caribbean (UMALCA) in the year 1998. A main objective is to contribute to the development of Mathematics in all regions of the continent, especially in Central America and the Caribbean, by introducing young people ti relevant topics of current interest and stimulating the most outstanding to continue postgraduate studies.

The special situation faced by most Central American countries in relation to the low development of this discipline, in comparison with other countries in the region, led in 2004 to the decision to make another EMALCA in the Central American region. The main purpose of these academic cooperation actions, in addition to promoting the interrelation of Central American students and professors, is to contribute to reducing the deficit of mathematical knowledge and the gap in research capacities in pure mathematics and applied between the countries of the region, as well as to increase in the medium term the human capital in Central America.

The EMALCA-EL SALVADOR had partial support of CIMPA (Center International of Pure and Apply Mathematics), IMU (International Mathematical Union), IMPA (Institute of Pure and Applied Mathematics), UNA (National University of Assumption), to finance the professors and student transportation. The hosts are responsible for ensuring funding to cover the attentions, the expenses of the stay and movement of students and teachers in the host country, involving 49 students including 33 local and 16 foreign students.

1.1 Objetivos específicos

- Strengthen a common Central American space to put students in contact with relevant topics of current interest, providing them with theoretical and applied knowledge on diverse areas of mathematics: Dynamic Systems, Numerical Methods , Optimization, Probability, Analysis, etc.
- Offer to the students of the region the opportunity to know current research topics in several areas of mathematics, taught by first level professors, as well as, to motivate them to undertake research projects that complement their undergraduate studies and stimulate the most outstanding ones to continue postgraduate studies.
- To strengthen cooperation ties and strengthen the management capacity of the universities of the Central American countries, in order to raise the mathematical potential of the region.

2 Organización

The institution that hosted the EMALCA was the Gerardo Barrios University.

The **Scientific Committee** was integrated by:

- Dr. Luis Mauricio Graña Drummond (Universidade Federal do Rio de Janeiro).
- Dr. Christian Schaerer (Universidad Nacional de Asunción, Paraguay).
- Lic. José Abraham Acosta (Universidad Gerardo Barrios, El Salvador).

The **Coordination Committee** was integrated by:

- Lic. José Abraham Acosta (Universidad Gerardo Barrios, El Salvador).
- Dr. Christian Schaerer, Universidad Nacional de Asunción, Paraguay

The **Local Organizing Committee** was integrated by:

- Ing. Raúl Rivas Quintanilla (Rector),
- MACI. Carlos Enrique Mendoza Moreno,
- Mspc. José Salvador Alvarenga Rivera,
- MSC. José Félix Rojas Cabeza,
- Lic. Cristian Ernesto Martínez Morejon,
- Lic. José Alfredo Hernández Pérez,
- Lic. Víctor Edgardo López Sandoval,
- Lic. José Abraham Acosta (General Local Coordinator EMALCA EL SALVADOR 2018)

3 Registration and scholarships

The deadline for registration to the school was June 15, 2018. The applicants had to fill out an application form where their personal data were requested and an analytical certificate of their studies in order to be able to make an order of merit to choose the participants to be financed. In total there were 49 accepted entries. The majority of requests from non-local participants asking some type of financing (either partial or total). The distribution according to the countries can be seen in Table 1.

	Surname	Name	Country
1	Quevedo Carranza	Billy Othmaro	Guatemala
2	Rosales Alarcón	Lourdes Kristel	Guatemala
3	Castañeda Paiz	Cristian Yovanni	Guatemala
4	Hernández Martínez	Oscar Adrián	Honduras
5	Sarmiento Perdomo	Yesy Karina	Honduras
6	Sosa Castellanos	Yani Eliud	Honduras
7	Benavides Maradiaga	Omar Edgardo	Honduras
8	Lopez Mejia	Diego Fernando	Honduras
9	Mejia Moreno	Marissa Denisse	Honduras
10	Leiva Castellanos	Wendy Vanessa	Honduras
11	Salinas Aguirre	Oscar Mauricio	Honduras
12	Arcia Ramírez.	Martha María	Nicaragua
13	Rios Hernández	Mynor Francisco	Nicaragua
14	Rodriguez Murillo	Jhon Alexander	Colombia
15	Rojas Pinzon	Sandra Milena	Colombia
16	Polanco Adames	Delvi Antonio	Republica Dominicana
17	Canales Benítez	Elmer Alexander	El Salvador
18	Vásquez Jiménez	Edwin Wilfredo	El Salvador
19	Arias Ortiz	Israel	El Salvador
20	Batres Páiz	Sara Margarita	El Salvador
21	Campos Saravia	Jorge Alberto	El Salvador
22	García Acosta	Yecson Duban	El Salvador

Table 1: List of students accepted for EMALCA EL SAlVADOR 2018. Part A.

	Surname	Name	Country
23	Gonzalez Romero	Jonathan Alexander	El Salvador
24	Interiano García	José Adolfo	El Salvador
25	Merlos Juárez	William Noé	El Salvador
26	Paiz Díaz	Boris Bladimir	El Salvador
27	Rodriguez Portillo	Kevin Josue	El Salvador
28	Vasquez Vasquez	José Fredy	El Salvador
29	Zaldivar Olivares	José David	El Salvador
30	Vásquez Hernández	Francisco Javier	El Salvador
31	González	Angel Roberto	El Salvador
32	Aparicio Ramírez	José Joaquín	El Salvador
33	Cubías de Medrano	Lisseth Stefany	El Salvador
34	Hernández Hernández	Mario Francisco	El Salvador
35	Molina Medrano	Oscar Rutilio	El Salvador
36	Rivera Sánchez	Vanessa De Jesús	El Salvador
37	Salazar Santana	Fidel Alfredo	El Salvador
38	Ortiz Cortez	Wilber Alexander	El Salvador
39	Martínez Hernández	Gerson Manuel	El Salvador
40	Vásquez Vásquez	José Manuel	El Salvador
41	Osorio Hernández	Michelle Guadalupe	El Salvador
42	Avalos Landaverde	Rodrigo Otmaro	El Salvador
43	Rodriguez Urias	Johanna Sarai	El Salvador
44	Turcios Reyes	Bernardo Antonio	El Salvador
45	Hernández Pérez	Erick yovani	El Salvador
46	Castellon Artola	Naren Isabel	El Salvador
47	Trejo Montiel	Bernanrdo	El Salvador
48	Trejo Montiel	Carlos Romeo	El Salvador
49	Carranza Galdamez	Daniel Ernesto	El Salvador

Table 2: List of students accepted for EMALCA EL SAlVADOR 2018. Part B.

3.1 Benefits provided by the Gerardo Barrios University

Due to the economic resources that the event had, it was possible to finance all the participants: 16 foreigners and 33 Salvadorans, 5 teachers. The support consisted of:

- Accommodation: Hotel Florencia San Miguel.
- Food during the 13 days that the school lasted: breakfast, lunch, dinner and 2 coffee breaks.

- Air ticket: round trip.
- Local transportation from the hotel to the university and vice versa.
- Ground transportation airport and hotel, similarly hotel and airport.
- Transportation and lunch, for the accomplishment of the academic conviviality, covering 100 % of the participants.
- Closing dinner, where participants were given diplomas of participation, approval of the courses and recognitions to the teachers and coordinators of the EMALCA.

These benefits were given for 13 days during the execution of the EMALCA, for covering all the needs of students.

Benefits provided to participants by the Gerardo Barrios University

Benefits	Accomodatio	Breakfast	Lunch	Dinner	Coffee Breaks	Local Transportation	Air Transportation
Participants	32	32	49	32	49	32	1

Table 3: Benefits for participants.

3.2 Benefits support by CIMPA

Table 4 presents the list of participants supported by CIMPA. A list of all admitted participants is presented, including name, age, status, institution, email and the part covered of the cost of their round trip transportation ticket.

Name	**Age**	**Status**	**Inst.**	**E-mail**
Rodriguez Murillo, Jhon Alexander	23	Student	UV	rodriguez.jhon@correounivalle.edu.co
López Mejía, Diego Fernando	33	Gradated	UPN	dlopez@upnfm.edu.hn
Benavides Maradiaga, Omar Edgardo	26	Student	UPN	omaredgardo2010@hotmail.com
Sosa Castellanos, Yani Eliud	26	Student	UPN	yanisosa99@gmail.com
Castañeda Paiz, Cristian Yovanni	24	Student	UG	n.a.
Martínez Pería, Francisco Dardo	39	Professor	UNLP	francisco@mate.unlp.edu.ar

Table 4: Supported by CIMPA. Acronyms: UV: Universidad del Valle - Colombia; UPN: Universidad Pedagógica Nacional - Honduras; USCG: Universidad San Carlos - Guatemala; UNAH: Universidad Nacional Autónoma de Honduras - Honduras; UNLP: Universidad Nacional de la Plata - Argentina.

3.3 Beneficios proporcionados por IMU

Table 5 presents a list of participants supported by IMU. A list of all admitted participants is presented, including name, age, status, institution, email and the part covered of the cost of their round trip transportation ticket.

Name	Age	Status	Inst.	E-mail
Castellon Artola, Naren Israel	33	Graduated	UNAN	naren8520@yahoo.com
Polanco Adames, Delvi Antonio	27	Graduated	UASD	delvipolanco2017@gmail.com
Leiva Castellano, Wendy Vanessa	21	Student	UNAH	wendy.leiva 97@outlook.com
Sarmiento Perdomo, Yesy Karina	23	Student	UNAH	karinasarmiento20@gmail.com
Hernández Martínez, Oscar Adrián	21	Student	UNAH	ohernandezm@unah.hn
Ríos Hernández, Mynor Francisco	21	Student	UNAN	riosmynor87@gmail.com
Arcia Ramírez, Martha María	34	Student	UNAN	
Rojas Pinzón, Sandra Milena	24	Student	UDFJC	fayira13@hotmail.com
Rosales Alarcón, Lourdes Kristel	26	Student	USCG	lkrosales9@gmail.com
Quevedo Carranza, Billy Othmaro	21	Student	USCG	bquevedo50@gmail.com
Salinas Aguirre, Oscar Mauricio	24	Student	UNAH	oscar2007salinas@hotmail.com

Table 5: Supported by IMU. Acronym: UASD: Universidad Autónoma de Santo Domingo - Santo Domingo; UNAN: Universidad Nacional Autónoma de Nicaragua - Nicaragua; UNAH: Universidad Nacional Autónoma de Honduras - Honduras; UDFJC: Universidad Distrital Francisco José de Caldas - Colombia; USCG: Universidad San Carlos - Guatemala.

3.4 Support distribution by institutions.

4 Meetings and opening ceremony

The school was held at the San Miguel headquarters in the eastern part of El Salvador, Gerardo Barrios University, with the support of the research unit of the same university. The inauguration was held in the Gerardo Barrios building, conference room 1 and 2 according to attached images, where the highest authorities of the university participated.

- Dr. Raúl Rivas Quintanilla (Rector)

Intituciones	Función
Univ. Gerardo Barrios	costos de: accomodation, breakfast, lunch, dinner, coffee break, local and international transportation, dinner and activities of fraternization.
Univ. Nacional de Asunción Facultad Politécnica	air transportation of a professor.
IMPA	air transportation of a professor.
Matej Bel University	air transportation of a professor.

Table 6: Institutions that directly supported.

Dean of several departments,

- Mspc. José Salvador Alvarenga Rivera
- MDF. Yaneth Rubidia Campos de Rivas
- M.Sc. MDE. Telma Nohemí García Ventura
- MACI. Azucena Edelmira Guevara de Urbina
- MACI. Carlos Enrique Mendoza Moreno
- MDI. Salvador Ernesto Manzanares
- Licda. María Alicia Vigil de Hernández

Participation of professors, coordinators and students.

Figure 1: Gerardo Barrios building.

Figure 2: Authorities, professors and lecturers.

Figure 3: Inauguration talk.

Figure 4: Dr. Christian Schaerer inauguration talk.

Figure 5: Participants with authorities.

Figure 6: Participants of the EMALCA

5 Courses and conferences

Three courses were dictated.

5.1 Course 1: Introduction to dynamical system

5.1.1 Professor

Figure 7: Dr. Pablo Carrasco UFMG - Universidad Federal de Minas Gerais, Belo Horizonte, Brasil.

5.1.2 Program

- Using one-dimensional functions of the line and the circle, we will try to motivate some of the basic problems of dynamic systems theory.
- 1. Notions of topological dynamics. Fixed and periodic points. Transitivity, minimality, recurrences.
- 2. Homeomorphisms of the circle. Rotation number Poincare's theorem. Morse - Smale systems.
- 3. Endomorphisms of the circle. Expansive and expanding applications. Chaos, stability and robustness. Symbolic dynamics. Sarkovskii's theorem.
- 4. Bifurcations. The quadratic family.

5.1.3 References

- K.T. Alligood, T. Sauer, J.A. Yorke, Chaos: An Introduction to Dynamical Systems, Springer-Verlag, 1996.
- R.L. Devaney, An introduction to chaotic dynamical systems, Addison-Wesley, Redwood City, California, 1989.
- M.A. Martín, M. Morán, M. Reyes, Iniciacioón al caos. Sistemas dinámicos, Editorial Síntesis, Madrid, 1995.
- Giraldo, M.A. Sastre, Sistemas Dinámicos Discretos y Caos. Teoría, Ejemplos y Algoritmos, Fundación General de la Universidad Politécnica de Madrid, 2002.

5.1.4 Photographs

Figure 8: Course 1.

Figure 9: View of the course

5.2 Course 2: Continuous Optimization-Elements of Convex Analysis and Optimization

5.2.1 Professor

Figure 10: Dr. Damián Fernández Facultad de Matemática, Astronomía, Física y Computación (FaMAF), Universidad Nacional de Córdoba (UNC).

5.2.2 Program

- In this course, basics of optimization theory and convex analysis will be introduced. In addition, descent systems and an introduction to non-smooth analysis will be presented.

1 Functions of several variables: derivative, directional derivative, higher order derivatives.

2 . Optimization without restrictions: optimality conditions.

3 Geometric concepts: tangent and normal cones.

4 Optimization with restrictions: Lagrange theory.

5 Convex sets and functions, first and second order characterizations.

6 Sub-differential, conjugate of Fenchel.

5.2.3 References

- R. T. Rockafellar, R. J-B Wets, Variational Analysis, Springer-Verlag, New York, 1997.
- J.-B. Hiriart-Urruty, C. Lemaréchal, Fundamentals of Convex Analysis, Springer Science & Business Media, 2001.

5.2.4 Photographs

Figure 11: Course 2

Figure 12: View of the course

5.3 Course 3: Functional Analysis-Theory of operators in Hilbert spaces

5.3.1 Professor

Figure 13: Dr. Francisco Martínez Pería, Universidad Nacional de La Plata, Argentina.

5.3.2 Program

- The objective of this course is to bring the reader closer to some basic topics of Functional Analysis and Theory of Operators, and the applications of these topics to approximation problems. The first two chapters concentrate the preliminaries of the course.

  In Chapter 1, it contains a synthetic presentation of the definitions and properties of Hilbert spaces. In Chapter 2, we study the linear operators bounded in these spaces; presenting the main classical results. In Chapter 3 the main geometrical tools of the course are introduced: orthogonal projections and different notions of angle between two closed subspaces of a Hilbert space. They are related and used to calculate the norm of an arbitrary oblique projection. Chapter 4 is devoted to the problem of minimum squares. Here the following problem will be studied: given a bounded linear operator $C : H\ K$ and a fixed vector $and\ epsilonK$, calculate those $u\ epsilonH$ such that $paralleland - Cu\ parallel\ leq\ paralleland - Cx\ parallel$ for all $x\ inH$. We will begin by recalling the classical approach (in finite dimension) and show that we can use the same geometrical argument to find conditions of existence and unique solutions. Later, we will relate this problem with the pseudoinverse of Moore-Penrose and the reduced minimum module of a linear operator of closed range. Finally, once the class of positive defined operators is introduced and characterized, we will define the Schur complement of one of these operators with respect to a closed subspace. We will present different characterizations of the Schur complement and we will relate it with the solutions of the equation $X = A - B * X - 1B$.

1 Hilbert spaces. Spaces with internal product and orthogonality. Distance associated with an internal product, Hilbert spaces. Linear functions on a Hilbert space. Riesz representation theorem. Orthonormal bases and Fourier coefficients.

2 Algebra of operators bounded in a Hilbert space. Linear operators acting between spaces with internal product. Theorem of the open application. Dimensioned operators. Closed graph theorem. Principle of uniform delimitation. Attached to a linear operator. Classes of linear operators (bounded). Polar decomposition

3 Angles between subspaces. Orthogonal and oblique projections. Angle definitions, main properties and applications. Norm of a projection.

4 Approach problems. The problem of minimum squares. The pseudoinverse of Moore-Penrose. Minimum module reduced.

5 Schur complement of a positive operator. Douglas Factorization Theorem: factorization of operators and range inclusions. Positive defined operators. Schur complement of a positive operator. Range, nucleus and different characterizations of the Schur complement. The equation $X = A - B * X - 1B$.

5.3.3 Reference

- J. B. Conway, A course in functional analysis, Springer-Verlag, 1985.
- J. B. Conway, A course in operator theory, Graduate studies in Mathematics 21, AMS, 2000.
- F. Deutsch, The angle between subspaces of a Hilbert space, Approximation theory, wavelets and applications (Maratea, 1994), 107–130, NATO Adv. Sci. Inst. Ser. C Math. Phys. Sci., 454, Kluwer Acad. Publ., Dordrecht, 1995.
- R. G. Douglas, On majorization, factorization and range inclusion of operators in Hilbert space, Proc. Amer. Math. Soc. 17 (1966), 413-416.
- R. G. Douglas, Banach algebra techniques in operator theory, Academic Press, New York, 1984.
- P. R. Halmos, A Hilbert space problem book, Springer-Verlag, New York, 1980.
- T. Kato, Perturbation theory for linear operators, Springer, New York, 1966.
- Kolmogorov, S. Fomin, Elementos de la teoría de funciones y del análisis funcional, Editorial MIR, 1965.
- G. K. Pedersen; Analysis Now, Spinger, Berlin, 1989.
- M. Reed, B. Simon, Functional Analysis, Academic Press, New York, 1975.
- D. Stojanoff, Análisis Funcional vs. Matricial, 2010.

5.4 Conference 1: Introduction to fuzzy logic

5.4.1 Lecturer

Figure 14: Dr. Vladimir Janiš Professor at the Department of Mathematics Faculty of Science, Matej Bel University Banska Bystrica, Slovak Republic

5.4.2 Program

Classical and many-valued logic. Fuzzy sets, fuzzy subsets of the real line. Set-theoretical operations. Connectives in fuzzy logic, negation,s conjunctions, disjunctions, implications. Triangular norms and conorms, Archimedean property, nilpotency, additive and multiplicative generators of triangular norms. Frank t-norms. Extension principle, its application in arithmetical operations with fuzzy numbers. Equivalence relations and partitions.

Figure 15: Conference: Introduction to fuzzy logic.

5.5 Conference 2: Mathematical models for transport phenomena

5.5.1 Lecturer

Figure 16: Dr. Christian Schaerer, Universidad Nacional de Asunción, Paraguay

5.5.2 Abstract

In this talk, I will discuss about the mathematical modeling of transport phenomena related to some physical problems. We will see convection, diffusion and reaction, and their application to practical cases such as: transport of pollutants and pollution in lakes. We will see explicit and implicit discretizations. We will see discretizations of the resulting equations, concepts of consistency, stability and convergence of discretizations. Finally, there will be cases where computational simulation and how the mathematical modeling play a preponderant role in the approach and solution of real systems.

Figure 17: Conference: Mathematical models for transport phenomena.

5.6 Conference 3: Mathematical Models for Topology 1D

5.6.1 Lecturer

Figure 18: Dr. Christian Schaerer, Universidad Nacional de Asunción, Paraguay

5.6.2 Abstract

In this talk I will present advances in the computational simulation and mathematical modeling of the topology of circular plasmids. We will discuss about topological in variants and the modeling using the worn chain model. In addition, I will discuss about replication intermediaries and how the topological invariants are considered in this context. Finally, some simulations are going to be shown.

Figure 19: Conference: Mathematical Models for Topology 1D.

5.7 Conference 4: Approximate reasoning

5.7.1 Lecturer

Figure 20: Dr. Vladimir Janiš Professor at the Department of Mathematics Faculty of Science, Matej Bel University Banska Bystrica, Slovak Republic.

5.7.2 Abstract

Linguistic variables. Fuzzy relations, basic operations, compositions, equivalence, closure, tolerance relation, negative transitivity, Ferrer's property. Information retrieval. Decision analysis Rule bases, if-then rules, inference rules. Mamdani and Tagaki-Sugeno regulators. Pattern recognition, the rule of maximum membership degree, the rule of threshold. Industrial applications. Construction of simple fuzzy regulators. Principles of fuzzy control.

Figure 21: Conference: Approximate reasoning.

5.8 Conference 5: Metric properties of fuzzy sets

5.8.1 Lecturer

Figure 22: Dr. Vladimir Janiš Professor at the Department of Mathematics Faculty of Science, Matej Bel University Banska Bystrica, Slovak Republic.

5.8.2 Abstract

Dissimilarities and divergences, axiomatic approach, practical examples. Role of measures of divergence in decision making. Convexity. Lattice-valued mappings, set-theoretical operations, their representation and decompositions. Triangular norms on lattices. IF-sets and interval-valued sets. Fuzzy measures and non-additive integrals. Fuzzy subgroups, subrings and ideals. Introduction to fuzzy topology.

Figure 23: Conference: Metric properties of fuzzy sets.

5.9 Evaluations

The professors of each course elaborated the exams based on the contents taught. The evaluation was in charge of the teachers of the courses. Students were given recognition for the approval of each course, and for their attendance. Attendance was provided by the organizing committee, who attended at least 80 % of class days in each course.

Criterios	
Approved	superior or equal to the minimum score to be approved.
Presence	Presence in at least 80% of a las classes.
	Do not reach in presence of at least 80% of the classes.

Lista de participantes y desempeño individual en los cursos

	Apellido	Nombre	País	Course1	Curso2	Curso3
1	Aparicio Ramírez	José Joaquín	El Salvador	Approved	Approved	Presence
2	Arcia Ramírez.	Martha María	Nicaragua	Presence	Presence	Presence
3	Arias Ortiz	Israel	El Salvador	Presence	Presence	Presence
4	Avalos Landaverde	Rodrigo Otmaro	El Salvador	Presence	Presence	Presence
5	Batres Páiz	Sara Margarita	El Salvador	Presence	Presence	
6	Benavides Maradiaga	Omar Edgardo	Honduras	Presence	Presence	Presence
7	Campos Saravia	Jorge Alberto	El Salvador		Presence	
8	Canales Benítez	Elmer Alexander	El Salvador	Presence		
9	Carranza Galdámez	Daniel Ernesto	El Salvador	Presence	Presence	Presence
10	Castañeda Paiz	Cristian Yovanni	Guatemala	Presence	Presence	Presence
11	Castellón Artola	Naren Isabel	El Salvador	Presence	Asistió	Presence
12	Cubias de Medrano	Lisseth Stefany	El Salvador	Presence	Asistió	Presence
13	García acosta	Yecson duban	El Salvador	Presence	Asistió	Presence
14	González	Ángel Roberto	El Salvador			
15	González Romero	Jonathan Alexander	El Salvador	Presence		Presence
16	Hernández Hernández	Mario Francisco	El Salvador	Approved	Approved	Approved
17	Hernández Martínez	Oscar Adrián	Honduras	Presence	Asistió	Presence

6 Program schedule

The EMALCA Schedule program is presented at Table 6.1 and 6.2. The participants arrived by Sunday, July 1, 2018.

Lista de participantes y desempeño individual en los cursos

	Apellido	Nombre	País	Course1	Curso2	Curso3
18	Hernández Pérez	Erick yovani	El Salvador	Presence		Presence
19	Interiano García	José Adolfo	El Salvador	Presence		Presence
20	Leiva Castellanos	Wendy Vanessa	Honduras	Presence	Asistió	Presence
21	López Mejía	Diego Fernando	Honduras		Asistió	Presence
22	Martínez Hernández	Gerson Manuel	El Salvador	Presence		Presence
23	Mejía Moreno	Marissa Denisse	Honduras			
24	Merlos Juárez	William Noé	El Salvador	Presence	Asistió	Presence
25	Molina Medrano	Oscar Rutilio	El Salvador	Presence	Approved	Presence
26	Ortiz Cortez	Wilber Alexander	El Salvador	Presence	Asistió	Presence
27	Osorio Hernández	Michelle Guadalupe	El Salvador	Presence	Asistió	Presence
28	Paiz Díaz	Boris Bladimir	El Salvador			
29	Polanco Adames	Delvi Antonio	República Dominicana	Presence	Asistió	Presence
30	Quevedo Carranza	Billy Othmaro	Guatemala	Approved	Asistió	Approved
31	Ríos Hernández	Mynor francisco	Nicaragua	Presence	Asistió	Presence
32	Rivera Sánchez	Vanessa De Jesús	El Salvador	Presence	Asistió	Presence
33	Rodríguez Murillo	Jhon Alexander	Colombia	Presence	Asistió	Presence
34	Rodríguez Portillo	Kevin Josué	El Salvador	Approved	Approved	Presence
35	Rodríguez Urías	Johanna Saraí	El Salvador			
36	Rojas Pinzón	Sandra Milena	Colombia	Presence	Asistió	Presence
37	Rosales Alarcón	Lourdes Kristel	Guatemala	Presence	Asistió	Presence
38	Salazar Santana	Fidel Alfredo	El Salvador	Presence	Asistió	Presence
39	Salinas Aguirre	Oscar Mauricio	Honduras	Presence	Asistió	Presence
40	Sarmiento Perdomo	Yesy Karina	Honduras	Presence	Asistió	Presence
41	Sosa Castellanos	Yani Eliud	Honduras	Presence	Asistió	Presence
42	Trejo Montiel	Carlos Romeo	El Salvador			
43	Trejo Montiel	Bernaldo	El Salvador	Presence		Presence
44	Turcios Reyes	Bernardo Antonio	El Salvador	Presence	Asistió	Presence
45	Vásquez Hernández	Francisco Javier	El Salvador	Presence	Asistió	Presence
46	Vásquez Jiménez	Edwin Wilfredo	El Salvador			
47	Vásquez Vásquez	José Fredy	El Salvador	Presence		Presence
48	Vásquez Vásquez	José Manuel	El Salvador	Presence	Asistió	Presence
49	Zaldívar Olivares	José David	El Salvador	Presence		Presence

6.1 First week

Hora	Monday 2	Tuesday 3	Wednesday 4	Thursday 5	Friday 6	Saturday 7
08:30 10:00	Opening event	Course1	Course1	Course1	Course1	
10:00 10:30	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break	
10:30 12:00	Course1	Course1	Course1	Course1	Course1	
12:00 13:30	lunch	lunch	lunch	lunch	lunch	Fraternization activity
13:30 15:00	Course1	Course2	Course2	Course2	Course2	
15:00 15:30	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break	
15:30 16:30	Conference 1		Conference 2		Conference 3	

Table 7: First week

6.2 Second week

Hora	Monday 9	Tuesday 10	Wednesday11	Thursday 12	Friday 13	Saturday 14
08:30 10:00	Course2	Course2	Course2	Course2	Course2	
10:00 10:30	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break	
10:30 12:00	Course2	Course3	Course3	Course3	Course3	
12:00 13:30	lunch	lunch	lunch	lunch	lunch	Returning
13:30 15:00	Course3	Course3	Course3	Course3	Course3	
15:00 15:30	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Closing event	
15:30 16:30	Conference 4	Conference 5				

Table 8: Second week

7 Closing event

The closing ceremony was held in the Hotel Florencia with the presence of Professors Dr. Damián Fernández y Dr.Francisco Martínez Pería, and MACI. Carlos Enrique Mendoza Moreno, Dean of the Faculty of Business Sciences and the organizing committee of EMALCA, where the young people and professors were awarded with a recognition for their participation. In the same way there was a convivial atmosphere, live music and dinner with typical dishes from El Salvador, as a way to strengthen the relations between the young people and motivate them to continue their postgraduate studies.


EMALCA
El Salvador 2018


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El Salvador 2018


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FTBL

8 Post-EMALCA

8.1 Meeting with the Minister of Education of El Salvador

It has been held a meeting with the Minister of Education of El Salvador, M.Sc. Carlos Canjura. In the opportunity it was discussed with the possibility of continuing the collaboration for the growth of

mathematics in the region and in especial of El Salvador.

Figure 24: Ministro de Educación Ing. Carlos Canjura

8.2 Meeting with authorities of the University Gerardo Barrios

During the EMALCA, it was performed with the authorities of the Gerardo Barrios University. In the opportunity was explored possibilities of activities for continuing activities for strengthening mathematics in the region. It has been very well received and a proposal is expected to be elaborated.

Figure 25: Meeting with authorities of UGB.

Figure 26: Meeting with authorities of UGB and the local organizing committee of EMALCA EL SALVADOR 2018.

9 Fraternization activity

Saturday, July 07 a fraternization was carried out on the beach "El cuco" 50 kilometers away from the city of San Miguel, hotel Leones Marinos, where the participants of the EMALCA had fun moments at the same time managed to chat with professors about future projects.

Gerardo Barrios University fully covered the transportation and food expenses of each E MALCA participant.

10 Patrocinadores

This EMALCA El SALVADOR 2018 was possible thanks to the support of the following institutions:

CIMPA - Centre International de Mathématiques Pures et Appliquées

IMU - Unión Matemática Internacional

IMPA - Instituto Nacional de Matemática Pura e Aplicada

UNA - Universidad Nacional de Asunción

UMB - Matej Bel University Banska Bystrica, Slovak Republic

UMALCA - Unión Matemática de América Latina y el Caribe

UGB - Universidad Gerardo Barrios

11 Agradecimientos

We thank the support of Gerardo Barrios University and the institutions that helped concretize the EMALCA El Salvador 2018: UMALCA, CIMPA, IMU, UNA, IMPA and UMB. We also thank the professors and lecturers: Dr. Pablo Carrasco, Dr. Francisco, Dr. Damián Fernández, Dr. Francisco Martz Per and Dr. Vladimir Janiš for their willingness with the school, Rector Ing. Raúl Rivas Quintanilla and Deans MACI. Carlos Enrique Mendoza Moreno, Mspc. José Salvador Alvarenga Rivera, for supporting the initiative; to the scientific committee Dr. Luis Mauricio Graña Drummond (inspiring the school from the beginning) and Dr. Christian Schaerer, MSC. José Félix Rojas Cabeza,Lic. Cristian Ernesto Martínez Morejon, Lic. José Alfredo Hernández Pérez, Lic. Víctor Edgardo López Sandoval,Lic. José Abraham Acosta for organizing the EMALCA El SALVADOR 2018.

Figure 27: Closing event