

Report on West Asia Mathematical Schools WAMS “Mathematics and their interactions”

<https://www.math.sciences.univ-nantes.fr/WAMS-CIMPA-IZMIR19/>

<http://www.en.sciences.uodiyala.edu.iq/pages?id=10>

October 27-November 3, 2019

Location of the school

Nesin Mathematics Village-Izmir-Turkey

Coordinators

- **Abdeljalil Nachaoui**, Laboratoire de Mathématiques-Jean Leray, Université de Nantes, France.
- **Fatima M. Aboud**, Department of mathematics, College of Sciences, University of Diyala.

Sponsors

CIMPA, University of Diyala, College of Science-University of Diyala, LMJL-Université de Nantes, Nesin Mathematics Village, IMU, University of Tikrit, College of Education of pure Sciences-University of Tikrit, Izmir Metropolitan Municipality



Scientific Committee

- **Abdeljalil Nachaoui**, Laboratoire de Mathématiques Jean Leray, Université de Nantes, France
- **Yusif S. Gasimov**, Azerbaijan University, Azerbaijan
- **Francois Jauberteau**, Laboratoire de Mathématiques Jean Leray, Université de Nantes, France
- **Abdelhalim Larhlimi**, Département Informatique, Université de Nantes, France
- **Tahseen H. Moubarak**, College of Sciences, University of Diyala, Iraq
- **Tamaz Tadumdaze**, Institute of Applied Mathematics, Tbilisi State University, Tbilisi, Georgia,

Local Organizing Committee

- **Fatima Aboud** (person in charge), Department of mathematics, College of Sciences, University of Diyala, Iraq
- **Ghassan Ezzulddin Arif**, Department of mathematics, College of Education for pure sciences, University of Tikrit, Iraq.
- **Karzan A. Berdawood**, College of Sciences, Department of Mathematics, University of Salahaddin-Erbil, Iraq
- **Burcu Gürbüz**, Department of Computer Engineering, Faculty of Engineering and Natural Sciences, Üsküdar University, Turkey.
- **Ash Can Korkmaz**, Nesin Mathematics Village, Turkey
- **Lieth A. Majeed**, Department of mathematics, College of Sciences, University of Diyala, Iraq
- **Ali NESİN**, Istanbul Bilgi University, Department of Mathematics and Nesin Mathematics Village, Turkey
- **Aycan Sahin**, Nesin Mathematics Village, Turkey

Lecturers and courses

- **Abdeljalil Nachaoui**, Laboratoire de Mathématiques Jean Leray, Université de Nantes, France A
Mathematical procedure for detecting osteoarthritis-induced cartilage degeneration
- **Fatima M. Aboud**, Department of mathematics, College of Sciences, University of Diyala, Iraq
Mathematical tools for partial differential equations analysis
- **Yusif S. Gasimov**, Azerbaijan University, Azerbaijan
Inverse Eigenvalue Problems with Applications to Some Mechanical Systems.
- **Abdelhalim Larhlimi**, Département Informatique, Université de Nantes, France
Mathematical methods in metabolic engineering for strain design
- **Amine Laghrib**, Mathematics Department, University of Sultan Moulay Sliman Beni Mellal, Morocco,
Introduction to Image processing and image restoration
- **Tahseen H. Moubarak**, College of Sciences, University of Diyala, Iraq
Concepts and methods of Mathematical physics and some of there applications

Description of Schools

The objective of this school is to present a fairly complete offer of courses in the modeling field, ranging from theoretical approaches to concrete developments (modeling and numerical simulations). The implementation and development of numerical approximation methods requires, first and foremost, a good knowledge of mathematical equations (differential equations, partial differential equations) but also the phenomena they account for. Finally, the efficient implementation of the associated approximation algorithms cannot be conceived without an introduction to computer skills.

These courses are intended for students, researchers or teaching researchers wishing to acquire an introduction to modern training in the field of mathematics and their applications in the fields intersected with mathematics.

Description of Course

- **Mathematical tools for partial differential equations analysis**

Partial differential equations and their numerical simulation are essential tools in both industry and research. The objective of this course is to provide some essential tools for the analysis of partial differential equations (PDEs). The content brings together notions and results from the functional analysis, and the study of some PDEs using these tools.

- **A mathematical procedure for detecting osteoarthritis-induced cartilage degeneration**

We introduce the inverse problem of the determination of the electrical potential on the cartilage from electrical potentials measured on the surface of the knee. The knee is modeled as a volume conductor composed of different regions characterized by specific electrical conductivities. We describe iterative methods developed for a class of bioelectrical field problems that arise in electrocardiography (ECG) and electroencephalography (EEG). The finite-element method is used to compute the potential distribution in the sequence of knee models (direct problems) induced by the algorithm of the inverse problem. We show how the non-homogeneity of the electrical conductivities can be handled by a nonoverlapping domain decomposition method. The implementation of the sequence the discrete problems is done using FreeFem.

- **Inverse Eigenvalue Problems with Applications to Some Mechanical Systems**

In this course, eigenvalue problems are considered for the elliptic operators with variable domain. Eigenvalues of these operators are taken as functional of the domain. Using the one to one correspondence between bounded convex domains and their support functions variation of the domain is expressed by the variation of its support function and calculate the first variation of this functional. Using the obtained formulas behavior of the eigenvalues is investigated when the domain varies. Then shape optimization problems are considered for the eigenvalues. The necessary conditions of optimality are proved, an algorithm is offered for the numerical solution

of the considered problems.

- **Mathematical methods in metabolic engineering for strain design**

Metabolic reactions play a fundamental role in sustaining cell growth. They import nutrients from the environment and they convert them into molecules needed by the living organism. Metabolic reactions do not operate in isolation; they form large-scale metabolic networks. In this lecture, we will introduce the main mathematical methods that are mandatory for predicting the behaviour of metabolic networks using constraint-based modeling. We will then present some methods that are used in metabolic engineering to design new strains.

- **Introduction to Image processing and image restoration**

In the last decade of the past century a great interest has been established by the mathematicians in the development of digital image processing as a science. The aim of this course is to introduce the image processing aspects and tools. Especially, we will focus on the image denoising and deconvolution techniques. Before presenting the main basic techniques for filtering images, we briefly recall the principle of one-dimensional filtering. We will see in the following that most filters act selectively on high frequencies to select them, in order to amplify or reduce them just as in the one-dimensional case. Based on the effect of filtering, we will introduce some partial differential equations (PDE's), such as Heat equation, which are used to reduce the noise. Finally, an implementation of different linear filters and PDE's will be investigated using the Matlab software.

- **Concepts and methods of Mathematical physics and some of their applications**

In this course we give some applications of Mathematical physics in some of real-life problems like complex electrical resistivity (which can be considered as a link between insulating material in physics and its variation during the use of the material with frequency and specially its applications at high frequency). Also, we study the effect of the energy in thermodynamics field by using integration to treat this subject. In addition, we talk about the relation between Mathematics and quantum mechanics and its quantum dot applications.

Courses, and Communications

The school was inaugurated by a short opening session in which the University of Diyala was represented by Professor Munthir H. Rathi, Assistant of the Dean of the College of Science.

This session was followed by a conference of professor Nachaoui introducing several examples of applications showing the interactions of mathematics with different branches of other sciences. This motivated the introduction of various analysis tools for the study of these problems.

The scientific program of the school included theoretical and practical lectures and time reserved for participants to present their works, the objective of this last possibility was to give the possibility to the participants to introduce their field of research to the other participants, to encourage those who cannot afford to go exhibit in international conferences. A total of 34 hours of theoretical sessions, 6 hours practical sessions and six hours of communications by the participants.

Among the participants, there were some non-mathematicians, a meeting was arranged with the engineers participants who have request to organize a future scientific course about the engineering applications of mathematics.

Participation

The participants came from seven countries and the participation of women is about 30% of the total of participation.

The school brought together some forty-four junior and senior researchers (see Appendix for the list of participants), including three French, five Turkish, two Uzbek, one Azerbaijani, one Moroccan, one Senegalese and thirty-two Iraqis (including four Kurds, from the Kurdistan-Iraq region). Some scientific participants from other departments (physics, biology and engineering) attended and appreciated the different courses of this school.

List of Participants

		Lecturers	
		Name	Institute
1	Miss	ABOUD Fatima	University of Diyala-Iraq
2	Mr	GASIMOV Yusif	Azerbaijan University, Azerbaijan
3	Mr	LAGHRIB Amine	University of Sultan Moulay Sliman Beni Mellal, Morocco
4	Mr	LAGHLIMI Abdelhalim	University of Nantes-France
5	Mr	MOUBARAK Tahseen	University of Diyala-Iraq
6	Mr	NACHAOUI Abdeljalil	University of Nantes-France
		Participants	
		Name	Institute
7	Mr	HAMDI Aws	University of Tikrit-Iraq
8	Mr	ABBAS Anas	University of Tikrit-Iraq
9	Ms	AJEENA Ruma Kareem	University of Babel-Iraq
10	Mr	Al-AZZAWI Munther Rathi	University of Diyala-Iraq
11	Mr	AL-AZZAWI Saad Naji	University of Bagdad-Iraq
12	Mr	AL-MAMOORI Mohammed	Almustaqbal Private University-Babel-Iraq
13	Mr	ALADOOL Ghassan	University of Mosul-Iraq
14	Mr	ALANI Mahmood	University of Mosul-Iraq
15	Miss	ALAZZAWI Ghufraan Ali	Almostansriya University-Iraq
16	Mr	ALBAKER Almutasim	University of Mosul-Iraq
17	Miss	ALDOORI Hind Gazi	University of Tikrit-Iraq
18	Mr	ALDOURY Nashwan Ghazi	Karabuk University-Turkey
19	Mr	ALSHAMARY Haider	University of Diyala-Iraq
20	Ms	ALTINTAN Derya	Selçuk University, Turkey
21	Mr	ARAVENA Andres	Istanbul University-Turkey
22	Mr	ARIF Ghassan	University of Tikrit-Iraq
23	Ms	BAGELANY Ronak Saeed	University of Kikuk-Iraq

24	Ms	BALTAEVA Iroda	Urgench State University, Uzbekistan
25	Ms	BALTAEVA Umida	Urgench State University, Uzbekistan
26	Mr	BERDAWOOD Karzan	University of Salahaddin-Iraq
27	Mr	CELIER Loic	University of Toulouse-France
28	Mr	GHITHEETH Ahmed Intisar	University of Mosul-Iraq
29	Mr	HUSSEIN Yasir	University of Tikrit-Iraq
30	Mr	JASIM Musaab	University of Diyala-Iraq
31	Mr	KAREEM Ahmad MURSHED	University of Diyala-Iraq
32	Mr	KHALAF Nihad Shareef	University of Tikrit-Iraq
33	Ms	KORMAZ Aslı Can	Nesin Mathematics Village, Turkey
34	Mr	MAJED Lieth	University of Diyala-Iraq
35	Mr	MECHEE Mohammed	University of Kufa-Iraq
36	Ms	OZPINAR Figen	Afyon Kocatepe University, Turkey
37	Mr	QASIM Ahmad Farook	University of Mosul-Iraq
38	Ms	RASHAD Ibtihal Qahtan	University of Tikrit-Iraq
39	Mr	RIDHA Sarkesh K.	Kirkuk University-Iraq
40	Ms	SAHIN Aycan	Nesin Mathematics Village, Turkey
41	Miss	SALIH Hero	University of Salahaddin-Iraq
42	Mr	SALIM Badran	University of Mosul-Iraq
43	Mr	TRAORE Moctar	İstanbul University/UCAD Senegal
44	Mr	YAHYA warif	University of Tikrit-Iraq

Some Important Links

- site of the school: <https://www.math.sciences.univ-nantes.fr/WAMS-CIMPA-IZMIR19/>
- CIMPA: <http://www.cimpa-icpam.org/>
- University of Diyala: <http://www.uodiyala.edu.iq/>
<http://www.en.sciences.uodiyala.edu.iq/>
<http://www.en.sciences.uodiyala.edu.iq/pageviewer.aspx?id=101>
- <http://www.rnta.eu/WAMS/>
- <https://www.cimpa.info/en/node/43>
- <http://www.nesinkoyleri.org/eng/events.php>

Poster of the school

West Asia Mathematical School
<http://www.rnta.eu/WAMS/>

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27 October to 3 November-
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Deadline: 15 September 2019
<http://www.en.sciences.uodiyala.edu.iq/pages?id=101>
Registration website:
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Gallery











