III INTERNATIONAL SCIENTIFIC CONFERENCE
MATHEMATICAL MODELING
11-14.12.2019, BOROVETS, HOTEL ELA

ORGANIZERS:

SCIENTIFIC-TECHNICAL UNION OF MECHANICAL ENGINEERING IN BULGARIA
"INDUSTRY 4.0" - BULGARIA
PETER THE GREAT ST.PETERSBURG POLYTECHNIC UNIVERSITY - RUSSIA

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Elena Bulkina, PhD student (RU)	Tatyana Egorova-Gudkova, Assoc. Prof. (UA)

INVITATION

Dear colleagues,

The study of the processes in different real systems is limited to their modelling, i.e. their approximate description by creating models of these systems and processes. Systems and processes models are divided into two classes - physical and mathematical. In recent decades, it has become clear that the notion of mathematical modelling refers equally to systems of another nature - social, economic, and others. In other words, the behaviour of different systems can be effectively explored using their mathematical models. It is only necessary to properly choose the appropriate mathematical apparatus. On the other hand, the range of mathematical models is extremely wide - from algebra and logic to functional analysis.

This means that the regular direct contacts between engineer researchers and specialists from different fields of mathematics are very important for the advancement of science and technology. For professional mathematicians, these contacts will enable them to better target the needs of representatives of other areas of knowledge. And the more contacts there are the better.

One of the most interesting problems of modern science is the development of methods and models for research and optimization of different systems. Thus knowledge is presented in a form that can be used. More and more mathematics is becoming the language of innovation and intelligent technologies and the modern industrial society.

All this will present you the International Scientific Conference *"MATHMODEL 2019",* which will be held from 11 to 14 December 2019 in the winter resort "Borovets", Bulgaria.

We invite the scientists and researchers from different scientific fields to present and discuss their new ideas, results of research, applications and experience in all aspects of modern mathematical methods and high-performance computing.

We hope that the International scientific conference *"MATHMODEL 2019"* will be a place for meetings and discussions of scientists from different countries fascinated by common ideas of knowledge and creativity.

The conference program will offer the opportunity for finding new friends and ideas, entertainments and the touch to the charm of the wonderful winter in the mountains.

Prof. D.Sc. ANDREY FIRSOV,
Chairman of the International Program Committee
Prof. D.Sc. GEORGI POPOV, DHC
President of Bulgarian Scientific-Technical Union of Mechanical Engineering

RESEARCH FIELDS

1. THEORETICAL FOUNDATIONS AND SPECIFICITY OF MATHEMATICAL MODELLING

Basic principles of mathematical modelling. Direct and inverse problems of mathematical modelling. Universality of mathematical models. Analogy principle. Model hierarchy.

Methodology of mathematical modelling. System analysis. Complex systems and decomposition. Static and dynamic models. Discrete and continuous. Deterministic and stochastic.

Ordinary and partial differential equations. Theory and applications. Applied algebra and numerical analysis. Numerical methods and optimization methods. Variation methods. Approximation, stability, convergence.

Probability theory and applied statistics. Stochastic processes. Combinatorics. Graph theory. Waiting line theory. Games theory. Statistical Theory of Expert Assessments.

Theory of management, optimization and their applications. Statistical modelling and applications.

New objects and methods of mathematical modelling. Fractals in mathematics. Dimensionality of self-similarity. Self-organisation and structure formation. Synergetics.

Software tools for mathematical modelling. Applied packages for engineering analysis. Mathematical modelling of future internet and development of future technologies for internet security. Mathematical models and intelligent information systems.

Mathematical modelling in fundamental and applied physics, mechanics, chemistry and biology.

2. MATHEMATICAL MODELLING OF TECHNOLOGICAL PROCESSES AND SYSTEMS

Technological processes as objects of automation. Approaches to construction of mathematical models. Main phases in analytical and experimental modelling. Mathematical methods of management.

Modelling of continuous and discrete processes and of complex production systems. Optimization. New methods and approaches.

Modelling of smart production technologies and systems. Modern machine building technologies – laser, plasma, ultrasound, radiation, optical, etc. Additive technologies and additive production. Digital production of optimal items made of metal, polymers, composites and ceramics.

Virtual technologies and simulations. Information and computer technologies. Robotics. Artificial intellect. Radio electronics. Instrument making. Communication and navigation engineering and technologies. Mathematical modelling and supercomputing engineering.

Modelling of materials, structures, systems - SMART technologies. Powder and plasma metallurgy. Materials science, physics, mechanics and chemistry of solid state. Composite materials and coatings. Strengthening technologies. Microtechnologies and micromechanical systems. Nanotechnologies, nanoelectronics, nanometrology, nanoequipment and nanoindustry.

Modelling of environmentally benign technology. Waste treatment. Energy engineering and technologies. Solar and hydrogen power generation. Energy recuperation.

Ecological modelling. Modeling of forest ecosystems. Modelling of integrated infrastructure and urban development, environment and ecology, global changes and nature risks, water resources.

Modelling in geology and geophysics. Extraction and processing of mineral raw materials. Mechanization, electrification and automation of mines.

Modelling of new and advanced technologies for designing and management of processes in petroleum refining and petrochemistry, chemical, metallurgical, plastic and rubber, paper and pulp, textile, leather, pharmaceutical and etc. industries.

Mathematical models and intelligent information systems in transport problems. Security and sustainable development. Virtual simulations and optimization of logistics processes.

3. MATHEMATICAL MODELLING OF SOCIO-ECONOMIC PROCESSES AND SYSTEMS

Socio-economic systems, methods for their study and modelling. Specific features of socio-economic processes modelling. Advantages and shortcomings of generally accepted approaches. Factors for the efficient modelling of processes. Up-to-date trends and computing complexes for modelling of socio-economic processes.

Statistical and stochastic models. Neural networks. Situation modelling.

Software for modelling and management of business processes. Program languages, tools and technologies for modelling and management of business processes.

Mathematical models of business strategies and management strategies. Industrial management. Production engineering and management. Technological entrepreneurship and innovation. Organisational behaviour and leadership. Social and behavioural simulation. Project management.

Models of innovation management, of innovation products and intellectual property marketing.

Nonlinear processes, system analysis and applied synergetics. Synergetic, geopolitical and geo-economic models on the targeted development of competitiveness and finances.

Modelling of clouds services, data analysis and assessment. 3D production simulation. Remote control and maintenance of facilities.

Modelling of Smart Factory, industrial infrastructure, integrated production and industrial restructuring; Industrial internet infrastructure.

Modelling of innovation and credit and taxation state policy as determining factor for the industry digitalisation development. Models on the effect of smart production technologies and systems on the financial sector and economic development. Global, regional and investment consequences. Investments in high tech sectors.

Mathematical models and social issues of production digitalisation. Models for concepts of human labour, employment, skills and strategies for the labour force development. Potential danger of unemployment. Digital competence. Matching the engineering and digital competences. E-training.

4. MATHEMATICAL MODELLING OF MEDICAL-BIOLOGICAL PROCESSES AND SYSTEMS

Specific features of modeling living systems. Methods and tools for mathematical modeling and computer science in theoretical biophysics, biology, medicine. the role of the models in the development of molecular and cell biology, systemic biology, physic-chemical biology, genetic and biomedical engineering, physiology, fundamental medicine.

Features of mathematical models of medical and biological systems: the presence of aftereffects in the dynamics of the describing system, the uncertainty (structured and unstructured) of the parameters of the mathematical model, the possible presence of random factors, the multicriteria of the tasks, often with conflicting criteria. Mathematical models of the dynamics of infectious diseases, the task of processing static and dynamic observations in real time.

Specific features of imitative modeling of biological processes and systems. Specialized languages for imitative modeling. Imitative modeling of nerve fibers conductivity.

Auto-oscillation processes in biological systems. Generalized model "predator - prey". Auto-oscillation in biochemical reactions. Fluctuation in photosynthetic processes.

Models for transport of substances through biomembranes. Diffusion. Cell membranes. Passive and active transport. Symport and antiport. Membrane exchangers.

Models of excitational environments. Membrane potential. Rest potential. Membrane patterns as electrical circuits.

Organism and principles of its management. Mechanisms of management - the impact of organ, body, population. Target function of control at cell level, organism, population. Evolutionary Optimality. Mathematical modeling of organisms.

Modeling of muscle impulses. Mathematical model of heart muscle. Modeling electrical and mechanical phenomena in the heart muscle. Modeling of the cardiac activity based on the theory of determined chaos. Modeling and simulation of the locomotor system and organs in the human body.

Mathematical models of diseases. Solution of diagnostic problems. Analysis of information flows in the medical care system. Synthesis of medical care systems.

Prospects in the development of the "virtual person". Artificial life and Virtual evolution. Computer modeling of the life forms.

4.1. SPECIAL MATHEMATICAL ISSUES, APPLICABLE IN THE PROBLEMS IN MODELING OF MEDICAL-BIOLOGICAL SYSTEMS

Mathematical approaches to the analysis of dynamic processes, based on the theory of image recognition, mathematical stability theory, statistical methods, computer technologies and decision making theory, methods for solving multicriteria problems.

The theory of differential-difference systems of delayed and neutral types. The direct Lyapunov method for analyzing stability and robust stability. Nonlinear systems and the area of asymptotic stability.

Systems with distributed parameters. Numerical methods for differential-difference systems and systems of partial differential equations: convergence, accuracy, stability, complexity. Discretization, accuracy estimation.

Control laws synthesis. Stabilization, adaptation of parameters, compensation of delays. Multi-agent systems and switching systems. Optimal control. New approaches to realizing control laws in real time.

Information systems and modern computer technologies. Features of application packages for medical diagnostics, planning and implementation of therapy, as well as further support of the patient.

Applications of graph theory in mathematical models of dynamical systems. Applications of graph theory in multidimensional dynamical equations systems of mathematical physics, including problems of identification of system parameters and stabilization of equilibrium states.

The official language of the International Scientific Conference **"MATHMODEL 2019" is English.**

CALL FOR PAPERS

Scientists from all over the world are kindly invited to present the results of their researches in the Plenary, Conference and Poster Sessions.

Paper's abstract up to 200-350 words in .doc or .docx format, with up to 10 keywords, authors' names and titles, occupation and e-mail address, together with the Author's Response (**Form A)** or the **online registration** has to be sent to the Organizing Committee not later than **30.09.2019.**

The Author's response Form A will be registered in the section **"Received Abstracts and Papers"** of the Conference web-site and a registration number will be given the paper. The Organizing Committee recommended the authors use this registration number in the further correspondence and if the files sent also begin with this number and the phrase **"MM19".**

For example: **131_Spenser_MM19.doc.**

Authors of the approved papers will be informed about the Program Committee's decision not later than **05.10.2019**.

Only papers formatted in accordance with the **graphical** and **text** instructions, accepted peer-reviewed and presented at the oral and poster Conference sections will be published.

The full text papers up to 4 pages, written in English, must be sent not later than **15.11.2019** by email, together with the Application form for participation **(Form B)** or **online registration**. The name of the paper's file has to consist of the registration number, author's name and the phrase "**MM19**". For example: "**131_Spenser_MM19.doc**"

If the authors cannot participate personally in the Conference, they can participate in the poster session. In that case the author should pay only the publication fee and the paper will be published in the International scientific journals (**www.stumejournals.com**). The poster papers have to be formatted according to the poster **graphical** and **text** instructions. They should be sent by e-mail until **01.12.2019** so the papers could be presented at the Conference. The Organizing Committee takes the obligation to print the poster and to include it in the poster session.

All instructions can be found on the Conference website: **www.mathmodel.eu**. On example of the title page can be downloaded there, so the authors could write easy the whole paper according to the requirements.

PUBLICATIONS

All papers included in the conference scientific program will be published as follows:

- **All reports** submitted on the Bulgarian, Russian, English: in a separate volume of "Proceedings International Scientific Conference MATHMODEL" with ISSN 2535-0978 (Print), ISSN 2603-3003 (Web) for each thematic session;

- **CD** containing all the papers;

- **Papers written in English:** in the separate issue of the International scientific journals according to the themes of the reports **(www.stumejournals.com):**

"**INDUSTRY 4.0**" ISSN (print) 2534-8582 и ISSN (on-line) 2534-8582

"**Security&Future**"(Print ISSN 2535-0668, Web ISSN 2535-082X)

"**Trans&Motauto World**" (Print ISSN 2367-8399, Web ISSN 2534-8493)

"**Science. Business. Society**" (Print ISSN 1313-0226, Web ISSN 2534-8485)

"**Machines. Technologies. Materials**" (Print ISSN 1313-0226, Web ISSN 1314-507X)

"**Innovations**" (Print ISSN 1314-8907, Web ISSN 2534-8469)

"**Mathematical Modeling**" (Print ISSN 2535-0986, Web ISSN 2603-2929)

FEES AND PAYMENTS

TYPE OF FEE	Euro	
	Up to 15.11.2019	After 15.11.2019
1. Conference fees: **1.1. Participation Fee** for participation in The International Scientific Conference **"MATHMODEL 2019"** **Includes:** Publishing in an issue of International scientific journals according to the themes of the reports, Welcome cocktail, Conference materials, coffee breaks, CD with all conference contributions.	150/ 100*	200 / 120*
1.2. Fee for second and third paper - only publication fee	90	130
2. Accompanying person (including co-authors) **Includes:** Welcome cocktail , Conference materials, coffee breaks	75	100
3. Publication fee *(For authors who cannot participate personally in the Conference)* **Includes**: Publishing in an issue of International scientific journals according to the themes of the reports, CD with all papers and printing of the poster paper in A1 format.	90	130
4. Additional payments: **4.1.** For receiving the printed issue of the journal at the Conference (volume with the papers).	20	20
4.2. For receiving the printed issue of the journal by post (volume with the papers).	30	30

*** Reduced fee for *Young scientists in 35 years.***

OVERNIGHT STAYS
Hotel "ELA"* - BOROVETS**
Price per night: single room 35 Euro, double room - 40 Euro
Hotel "RILA"*- SOFIA**
Price per night: single room 40 Euro, double room - 50 Euro

PAYMENTS
Bank transfer to the account of the Scientific and Technical Union of Mechanical Engineering at ProCredit Bank:
IBAN: BG53 PRCB 9230 1449 8985 01, **BIC: PRCBBGSF**
Beneficiary: NTS Mashinostroene-Industry 4.0.
Please write in the payment document "**MM'19**" and your registration number which you may find here: **http://www.mathmodel.eu** in the section "Received abstracts and papers".
In cash at the office of the Scientific and Technical Union of Mechanical Engineering: 1000 Sofia, 108 "G. S. Rakovski" Str. Office №411.
All bank charges related to the transfer are borne by the participant.

GENERAL INFORMATION

THE VENUE
Hotel Ela
Registration, opening, plenary and sectional sessions: **Hotel Ela (Fir-tree)***.**
Address: Samokov, Borovets resort, Hotel Ela.

ACCOMMODATION
Hotel Ela (Fir-tree)* at the Borovets winter resort.**
The Borovets winter resort is located at 1350 m above the sea level on the northern slopes of the Rila mountain, 70 km southeasterly from Sofia and 10 km from the town of Samokov. The climate of the resort is temperate; the winter is mild with loads of snow. The average temperature in

January – the coldest month is minus 4,8 C°. Usually the ski season starts in the beginning of December and closes in April.

Hotel Ela is located in the ideal centre of the Borovets winter resort. The hotel is situated close to the gondola lift station for Yastrebets and the Musala peak (2925 m) and 300 m from the drag lifts.

Visual information about the resort "Borovets" can be found at:

https://www.youtube.com/watch?v=WUMNYPQ5W1Y
https://www.youtube.com/watch?v=GjRGTnSNEA0

Address: Samokov, Borovets resort, Hotel Ela

In case you travel by car, you can use the GPS coordinates of Hotel Ela:
GPS - 42.26757, 23.60381

CITY TRANSPORT TO HOTEL ELA

From Sofia Airport by underground to Joliot-Curie station. The South coach station is located 50 m in the south of the underground station, under the bridge of Dragan Tsankov boulevard. The buses for Samokov depart every 30 minutes.

The travel duration is 1 hour approximately. Ticket price – 5.00 leva (~ 2.5 €).

Minibuses depart every 30 minutes to the Borovets resort at the Samokov coach station, sector No 2. The travel duration is 10-12 minutes approximately. Ticket price - 1,30 leva (~ 0.65 €). First bus departs for Borovets resort at 7:00 and the last one at 19:00. Taxi fare from Samokov coach station to Hotel Ela: 10-12 leva (~ 5-6 €).

Hotel Ela is located 20 m from the last station, in reverse direction of arrival.

Hotel Rila – City of Sofia

The lodging for the night in Hotel Rila, Sofia is reserved for conference participants, who would like to sightsee Sofia, or the transport connections do not allow an immediate departure to the Borovets resort. The Hotel Rila is located at the exact centre of Sofia, very close to the Serdika underground station.

From Sofia Airport by underground to Serdika station. At 150 meters southeast is located Hotel Rila.

Address: Sofia 6, Tsar Kaloyan St., Hotel Rila.

TIME TABLE

11.12.2019 (Wednesday**)** Registration of the participants.

12.12.2019 (Thursday**)** Opening ceremony 10:00. Plenary session. Conference sessions. Poster session. Welcome party.

13.12.2019 (Friday**)** 09:00 Conference sessions. Closing of the Conference.

14.12.2019 (Saturday**)** Departure of the participants.

REGISTRATION

In the lobby of the Hotel ELA - Borovets

11.12.2019 from **16:00** to **20:00** and

12.12.2019 from **08:00** to **10:00**.

ENTRY TO BULGARIA

Visitors from the European Union coming to Bulgaria need an identity document.

Visitors from other countries require an entry visa.

Visitors are recommended to contact the Bulgarian Embassy (you can find them on: *http://www.mfa.bg/*) or Consulate in their own country for information on visa requirements. If an official letter of invitation is requested, please contact the conference Secretariat in due time (before the registration deadline).

TIME

Bulgaria is in the Eastern European Time Zone (GMT+2)

WEATHER

Average air temperature in Borovets in the period 10-15 December, 2018– minus 2,5 $^{\circ}$C.
Snow cover out on the slopes in Borovets during the period 10-15 December, 2018 – 160 cm.
Check the weather in real time here: *http://weather.bg/indexen.php*.

CURRENCY

The official currency is the lev (plural: leva).
1 euro = 1.95583 lev
All major credit cards (e.g. VISA, MasterCard, Eurocard) are usually accepted in Bulgaria

EMERGENCY SERVICES

Uniform European telephone number for emergency situations: *112*

DEADLINES

The Abstract of the paper and Author's Response Form "A" or online registration should be sent up to	**30.09.2019**
Confirmation of the abstract approval	**05.10.2019**
The Full text of the paper(s) and Participation Form "B" or online registration should be sent up to	**15.11.2019**
Payment of the Conference fees	**15.11.2019**
Announcement of the Conference program on the web page: http://www.mathmodel.eu	**01.12.2019**
The Organizing Committee will receive posters up to	**01.12.2019**
Registration of the participants 16:00 – 20:00	**11.12.2019**
08:00 – 10:00	**12.12.2019**
Opening of the Conference - 10:00	**12.12.2019**
Departure of the participants	**14.12.2019**