

Symposium Nonlinear Dynamics – Milutin Milanković

Multidisciplinary and Interdisciplinary Applications (SNDMIA 2012), Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

Symposium

# Nonlinear Dynamics – Milutin Milanković

### Multidisciplinary and Interdisciplinary Applications

## (SNDMIA 2012),

Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

> Editors: Katica R. (Stevanović) HEDRIH Žarko Mijajlović

# **Booklet of Abstracts**

Symposium Nonlinear Dynamics – Milutin Milanković

Multidisciplinary and Interdisciplinary Applications (SNDMIA 2012), Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences

Main organizers:

Department of natural-mathematical sciences of Serbian Scientific Society and supported by Project ON174001 (2011-2014) coordinated through Department of Mechanics at Mathematical Institute SANU

> Support by Ministry of Education and Science Republic of Serbia <u>http://www.mpn.gov.rs/sajt/</u>



### Suppotyed by Co-organizers scientists from

Serbian Society of Mechanics, Institute "Mihajilo Pupin" Belgrade, Institute "Vincha", The Society of Physical Chemists of Serbia Faculty of Physical Chemistry University of Belgrade and Faculty of Technical Sciences Kosovska Mitrovica, University of Pristina with allocated place in Kosovska Mitrovica.



Venue of Symposium - Mathematical Institute SANU Ul. Knez Mihailova 36/III, Auditoria I



October 1, 2012, Belgrade, Serbia

Dear Participant,

The Symposium Nonlinear Dynamics - Milutin Milanković, Multidisciplinary and Interdisciplinary Applications, (SNDMIA 2012), Belgrade, October 1-5, 2012., (Eigth Serbian Symposium in area of Non-linear Sciences), (Симпозијум Нелинеарна динамика - Мулти и интердисциплинарне примене) is held in Belgrade, Sebia, and is organized by the Serbian Scientific Society and supported by Project ON174001 (2011-2014) coordinated through Department of Mechanics at Mathematical Institute SANU, in the framework of the scientific activities of the active researchers in area of Nonlinear Dynamics in Serbia and Russia.

Scientific support to the Symposium Nonlinear Dynamics - Milutin Milanković, Multidisciplinary and Interdisciplinary Applications, (SNDMIA 2012), Belgrade, October 1-5, 2012 is given by following scientific institution in Serbia: Serbian Society of Mechanics, Institute "Mihajilo Pupin" Belgrade, Institute "Vincha", The Society of Physical Chemists of Serbia, Faculty of Physical Chemistry University of Belgrade and Faculty of Technical Sciences Kosovska Mitrovica, University of Pristina with allocated place in Kosovska Mitrovica.

Financial support in part is given by Ministry of Education, Science and Technology Republic of Serbia\_http://www.mpn.gov.rs/sajt/.

The objective of the SYMPOSIUM is to bring together scientists and engineers

working in different areas of science to present and discuss recent developments on different problems of nonlinear dynamics with multi and interdisciplinary applications.

#### **Technical Program**

- Plenary Lectures (13 Plenary Lectures by Leading Scientists in Nonlinear Dynamics 40 minutes Lectures)
- Invited Lectures and Keynote Lectures (12 Invited Lectures or Keynote Lectures in sessions in different topics of natural-mathematical sciences and engineering – 30 minutes);
- Contributed Lectures and Presentations by Symposia participants (Contributed Lectures and Presentations accepted by Symposium Scientific Committee 20 minutes; ).

#### MAIN TOPICS OF THE SSYMPOSIUM

A\* Models and methods (analytical, numerical, geometrical, experimental) in nonlinear dynamics. Qualitative and quantitative analysis of nonlinear dynamic systems.

B\* Nonlinear dynamics of continuous, discontinuous and hybrid systems.

C\* Bifurcations and chaos.

D\* Nonlinear stochastic systems.

E\* Nonlinear dynamic phenomena.

F\* Control of oscillations and chaos.

G\* Applications in mechanics at different scales, and real problems from any branch of engineering science including mechanical, civil, electronic, electrical, communication, medical, materials.

Project ON174001

H\* Cross-disciplinary topics from applied mathematics, physics, biophysics, genetics, nanotechnology, finance, medicine and earth sciences.

# A ROUND TABLE: Research ethics and evaluation of scientific and technological research results.

Since 1992, the European Mechanics Society (EUROMECH) organizes European Nonlinear Oscillations Conferences (ENOCs) through its ENOC Committee. Actually, these events have a much longer tradition, since they are successors of the former ICNO (International Conference on Nonlinear Oscillations) series held from 1961 to 1990 in East-European countries. Starting with the 1st International Conference on Nonlinear Oscillations organized in Kiev, 1961, by Professor Yu. A. Mitropolsky, twelve ICNOs were held till 1990. Then, starting with the 1st European Nonlinear Oscillations Conference in Hamburg, 1992, six ENOCs were organized till 2008 (Prague, Copenhagen, Moscow, Eindhoven, St. Petersburg). Details are done in Appendix II.

Professor G. Rega was organizer last ENOC Rome 2012 and we poit out his sentences: "It is a great privilege to host the 50th Anniversary Conference of the ICNO-ENOC series in Rome, for the first time in a South-European country".

First Serbian Scientific meeting in area of Nonlinear mechanics (nonlinear oscillations and nonlinear dynamics) is organized by Serbian Society of Mechanics and Yugoslav society of Mechanics in 1984 in Arandjelovac. Academician Yu. Alekseevich Mitropolsky attend this Serbian Symposium and give one Plenary invited Lectures.Starting from this period Series of the scientific Symposia or Mini-Symposia is organized by Cher of Mechanics of Mecanical Engineering Faculty University of Niš supported bu Yougoslav or Serbian Society of Mechanics. Details are done in Appendix III.

We are happy to report that our **Symposium Nonlinear Dynamics** – **Milutin Milanković** has largely them previous with 83 accepted abstracts of the nonlinear dynamics contributions in different area of sciences from 12 countries are accepted and included in the program. A few Regular Sessions and one Special Session were organized.

We would like to thank all participants for their scientific contribution to **Symposium Nonlinear Dynamics – Milutin Milanković**, as well as colleagues and friends who meaningfully helped with the organization.

On behalf of the Serbian Scientific Society, welcome to Belgrade, the "Nice City", and enjoy a scientifically stimulating and socially pleasant **Symposium Nonlinear Dynamics – Milutin Milanković**!

We would like to wish all participants of this Symposium a warm welcome to our country and our Serbian Scientific Society and Venue Symposia place at Mathematical Institute SANU.

We would like to welcome you, hoping that creative efforts and achievements will prevail over preemption.

Katica R. (Stevanović) HEDRIH and Žarko Mijajlović Chairs of Symposium Nonlinear Dynamics – Milutin Milanković Serbian Scientific Society



(Eigth Serbian Symposium in area of Non-linear Sciences)

## Serbian Scientific Society

Symposium Nonlinear Dynamics – Milutin Milanković

**Multidisciplinary and Interdisciplinary Applications** (SNDMIA 2012), Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

Symposium

## Nonlinear Dynamics – Milutin Milanković

### With Multidisciplinary and Interdisciplinary Applications

## (SNDMIA 2012),

Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

> Editors: Katica R. (Stevanović) HEDRIH Žarko Mijajlović

# PROGRAM





#### Venue of Symposium-Mathematical Institute SANU, Ul. Knez Mihailova 36/III, Auditoria I

#### October 1, 2012 at 09,00h-09,40 h

Opening of the Symposia Nonlinear Dynamics - Svečano otvaranje simpozijuma

#### Speakers

\* Members of Honorary Scientific Committee

\* President of Serbian Scientific Society

\* Invited Speakers - Scientists

\*Chairman of Symposium: SYMPOSIUMS ON NONLINEAR MECHANICS IN SERBIA, ICNO AND ENOC

#### October 1, 2012 at 9,45h-10,25 h, Plenary Lecture

Chairs: H. Yabuno, Marina V. Shitikova and Dragan Milosavljević

PL-1. ID-60. DYNAMICS OF MULTI-VALUED VECTOR FIELDS WITH BOUNCING FLOWS IN DISCONTINUOUS DYNAMICAL SYSTEMS, Albert C. J. Luo, Mechanical and Industrial Engineering, Southern Illinois University Edwardsville, U. S. A.

#### October 1, 2012 at 10,30h-11,10h, Plenary Lecture

Chairs: H. Yabuno, Marina V. Shitikova and Dragan Milosavljević

L-2. ID-6. SMALL NONLINEAR OSCILLATIONS OF THE SATELLITE IN AN WEAKLY ELLIPTICAL ORBIT PLANE (THE COMPARATIVE ANALYSIS OF ASYMPTOTIC METHODS OF RESEARCH)

P.S. Krasilnikov, Department of Differential Equations, Moscow State Aviation Institute, Russia.

Break 11,10h-12,00h

#### October 1, 2012 at 12,00h-12,40h, Plenary Lecture

Chairs: Albert C. J. Luo, Ljiljana Kolar-Anić and Yury A. Rossikhin

PL-3. ID-67. EXPERIMENTAL INVESTIGATESIONS OF ANALYSIS AND CONTROL OF NONLINEAR PEHNOMENA IN SOME MEHCANICAL SYSTEMS, H. Yabuno, Department of Mechanical Engineering, Faculty of Science and Technology, Keio University, JAPAN

Break 12,50-13,00h

#### October 1, 2012 at 13,00h-14,00h, Invited Lectures

Chairs: Albert C. J. Luo, Ljiljana Kolar-Anić and Yury A. Rossikhin.

IL-1. ID-5. GENERALIZED VAN DER POL OSCILLATORS: FROM A LIMIT CYCLE TO THE ENTRAINMENT PHENOMENON, I. Kovacić, Department of Mechanics, Faculty of Technical Sciences, University of Novi Sad, 21 000 Novi Sad, Serbia.

**IL-2. ID-34. WALL FUNCTION CONCEPT FOR MODELING TURBULENT CHANNEL FLOW, B.** Stankovic<sup>1</sup>, M. Sijercic<sup>1</sup>, S. Belosevic<sup>1</sup>, **S. Cantrak<sup>2, 1</sup>** Institute of Nuclear Sciences "Vinca", Belgrade University, Laboratory for Thermal Engineering and Energy, Belgrade , <sup>2</sup> Faculty of Mechanical Engineering, Belgrade University, Belgrade, Serbia.

#### October 1, 2012 at 14,00h-14,40 h, Contributed Lectures

**Chairs:** Ivana Kovačić, O. Kholostova and I. Ryabicova

**CL-1. ID-1. NONLINEAR DYNAMIC EFFECTS IN CYCLIC MACHINES**, **I. Vulfson**, St.-Petersburg State University of Technology and Design, Bolshaya Morskaya, 18, 191186, St-Petersburg, Russia.

CI-2. ID-9. UNEXPECTED FEATURE OF NEW OSCILLATING HOMOGENEOUS REACTIONS: ALKYNES CARBONYLATION IN Pd COMPLEXES SOLUTIONS, Sergey N. Gorodsky, Department of Basic Organic Synthesis, Moscow State University of Fine Chemical Technologies (MITHT), Moscow, Russia

#### Break 14,40-16,00h

#### October 1, 2012 at 16,00h-19,30h, Invited Lectures - Special Session

**Chairs:** Boris A. Malomed, Milivoj Belić and A. Maluckov.

**IL-3. ID-52. EXACT SOLUTIONS TO THE MULTIDIMENSIONAL GENERALIZED NONLINEAR SCHRÖDINGER EQUATION AND THEIR STABILITY, Milivoj Belić**<sup>a</sup>, Wei-Ping Zhong<sup>b</sup>, Nikola Petrović<sup>c</sup>, Najdan Aleksić<sup>c, a</sup>Texas A&M University at Qatar, 23974 Doha, Qatar, <sup>b</sup>Shunde Polytechnic, Shunde 528300, China, <sup>c</sup>Institute of Physics, University of Belgrade, Serbia

IL-4. ID-53. BIFURCATIONS AND SYNCHRONIZATION IN SYSTEMS OF REALISTIC NEURONAL MODELS, Nikola Buric, Institute of Physics, University of Belgrade

IL-5. ID-51. GEOMETRIC RESONANCES IN BOSE-EINSTEIN CONDENSATES WITH TWO-AND THREE-BODY INTERACTIONS, A. Balaž<sup>1</sup>, H. Al Jibbouri<sup>2</sup>, I. Vidanović<sup>3</sup>, Axel Pelster<sup>4</sup>, (<sup>1</sup> Scientific Computing Laboratory, Institute of Physics Belgrade, University of Belgrade, Serbia, <sup>2</sup> Institute for Theoretical Physics, Free University of Berlin, Germany, <sup>3</sup> Scientific Computing Laboratory, Institute of Physics Belgrade, University of Belgrade, Serbia, <sup>4</sup> Department of Physics and Research Center OPTIMUS, Technical University of Kaiserslautern, Germany)

IL-6. ID-56. NONLINEAR IONIC PULSES ALONG MICROTUBULES, Miljko V. Satarić, Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia

IL-7. ID-57. SOLITON DYNAMICS IN ONE-DIMENSIONAL WAVEGUIDE ARRAYS WITH SATURABLE, SELF-DEFOCUSING NONLINEARITY, M. Stepić<sup>1</sup>, P. P. Beličev<sup>1</sup>, A. Maluckov<sup>1</sup>, I. Ilić<sup>1</sup>, D. Kip<sup>2</sup>, A. Kanshu<sup>2</sup>, C.E. Rüter<sup>2</sup>, V. Shandarov<sup>3, 1</sup> Vinča Institute of Nuclear Sciences, Belgrade, Serbia, <sup>2</sup> Faculty of Electrical Engineering, Helmut Schmidt University, Hamburg, Germany, <sup>3</sup> State University of Control Systems and Radioelectronics, Tomsk, Russia

IL-8. ID-54. ULTRAFAST-LASER FABRICATION OF PHOTONIC COMPONENTS, J. Petrović<sup>1</sup>, V. Mezentsev<sup>2</sup>, <sup>1</sup> Institute of Nuclear Sciencies Vinca, Beograd, Serbia

IL-9. ID-55. SELF-ORGANIZATION IN THE HIDDEN MARKOV MODEL OF WAVELET SIGNAL PROCESSING, M. Milovanović<sup>1</sup>, M. Rajković<sup>2</sup>, <sup>1</sup>Mathematical Institute of the Serbian Academy of Arts and Sciences, Belgrade, <sup>2</sup>Vinca Institute of Nuclear Sciences, Belgrade, Serbia,

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#### October 2, 2012 at 8,30h-09,40 h, Contributed Lectures

**Chairs:** Ilya B. Simanovskii, I. Vulfson and Ljiljana Kolar-Anić.

**CL-14. ID-8. CHAOTIC OCCURRENCE OF THE RECORDED EARTHQUAKE MAGNITUDES IN SERBIA**, **S. Kostić<sup>1</sup>**, **N. Vasović<sup>2</sup>**, <sup>1</sup> University of Belgrade Faculty of Mining and Geology, Djusina 7, Belgrade, Serbia, <sup>2</sup> University of Belgrade Faculty of Mining and Geology, Djusina 7, Belgrade, Serbia, e-mail:

**CL-15 ID-7. A SIMPLE MODEL OF EARTHQUAKE NUCLEATION WITH TIME-DELAY**, **S. Kostić<sup>1</sup>**, I. Franović<sup>2</sup>, K. Todorović<sup>3</sup>, N. Vasović<sup>4</sup>, <sup>1</sup> University of Belgrade Faculty of Mining and Geology, Belgrade, Serbia, <sup>2</sup> University of Belgrade Faculty of Physics, Belgrade, Serbia, <sup>3</sup> University of Belgrade Faculty of Pharmacy, Belgrade, Serbia, <sup>4</sup> University of Belgrade Faculty of Mining and Geology, Belgrade, Serbia.

CL-9. ID-74. NONLINEAR OSCILLATIORY FLOWS WITH DIFFERENT SYMMETRY PROPERTIES IN TWO-LAYER SYSTEMS, Ilya B. Simanovskii, Department of Mathematics, Technion, Israel Institute of Technology, Haifa, Israel

#### October 2, 2012 at 9,45h-10,25 h, Plenary Lecture

#### Chairs: A. Markeev, Žarko Mijajlović and Pavel Krasilnikov.

**PL-4. ID-21. BRIGHT SOLITONS IN SELF-DEFOCUSING MEDIA,** Olga V. Borovkova,<sup>1</sup> Yaroslav V. Kartashov,<sup>1</sup> Valery E. Lobanov,<sup>1</sup> **Boris A. Malomed**,<sup>2,1</sup> Lluis Torner,<sup>1</sup> and Victor A. Vysloukh<sup>3,1, 1</sup>ICFO-Institut de Ciencies Fotoniques, and Universitat Politecnica de Catalunya, 08860 Castelldefels (Barcelona), Spain, <sup>2</sup>Department of Physical Electronics, School of Electrical Engineering, Faculty of Engineering, Tel Aviv University, Tel Aviv 69978, Israel, <sup>3</sup>Departamento de Fisica y Matematicas, Universidad de las Americas – Puebla, Mexico

#### October 2, 2012 at 10,30h-11,10h, Plenary Lecture

**Chairs:** A. Markeev, Žarko Mijajlović and Pavel Krasilnikov.

PL-5. ID-30. FURTHER RESULTS ON APLICATIONS OF FRACTIONAL CALCULUS IN NONLINEAR DYNAMICS - STABILITY AND CONTROL ISSUES, M. Lazarević' Department of Mechanics, Faculty of Mechanical Engineering, Serbia.

#### Break 11,10h-12,00h

#### October 2, 2012 at 12,00h-12,40h, Plenary Lecture

Chairs: Mihailo Lazarević, Albert Luo and Stevan Maksimović

PL-11. ID-84. FRACTIONAL DERIVATIVE VISCOELASTIC MODELS IN THE WAVE THEORY OF IMPACT, Yury A. Rossikhin and Marina V. Shitikova, Research Center on Dynamics of Solids and Structures, Voronezh State University of Architecture and Civil Engineering, Voronezh, Russia

#### Break 12,50-13,00h

#### October 2, 2012 at 13,00h-15,00h, Invited Lectures

Chairs: Alexander V. Rodnikov, Sergey N. Gorodsky and Stevan Maksimović

IL-10. ID-36. DIFFERENTIAL EQUATIONS OF MOTION OF MECHANICAL SYSTEMS WITH NONLINEAR NONHOLONOMIC CONSTRAINTS – VARIOUS FORMS AND THEIR EQUIVALENCE, Zekovic N. Dragomir, University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia.

IL-11. ID-3. SOME ASPECTS OF BIRD IMPACT THEORY, M. Ugrčić<sup>1</sup>, <sup>1</sup> Economics Institute, Belgrade, Serbia.

IL-12. ID-73. THE USE OF FINITE ELEMENTS METHOD IN VIBRATIONAL PROPERTIES CHARACTERIZATION OF MOUSE EMBRYO IN ICSI, A. Hedrih<sup>1</sup>, M. Ugrčić<sup>2</sup>, <sup>1</sup> State University in Novi Pazar, Novi Pazar, Serbia, <sup>2</sup> Economics Institute, Belgrade, Serbia.

IL – 13. ID-15. RAYLEIGH-BENARD CONVECTIVE INSTABILITY IN THE PRESENCE OF TEMPERATURE MODULATION, M. Jovanović<sup>1</sup>, D. Živković<sup>2</sup>, J. Nikocijević<sup>3</sup>, <sup>1,2,3</sup> University of Niš, The Faculty of Mechanical Engineering, Niš, Serbia.

#### Break 15,00-16,30h

#### October 2, 2012 at 16,30h-19,10h, Contributed Lectures

Chairs: S. Cantrak, M. Jovanović and A. Zlenko.

CL-4. ID- 27. STABILITY INVESTIGATION OF A RIGID BODY AND A SYSTEM OF RIGID BODIES UNDER RAPID VIBRATIONS, O. Kholostova, Faculty of Applied Mathematics and Physics, Moscow Aviation Institute (National Research University), Moscow, Russia.

CL-5. ID- 32. THE NEW FORM OF FORCE FUNCTION OF TWO FINITE BODIES IN TERMS OF MODIFIED DELAUNAY'S AND ANDOYER'S ANGLE VARIABLES, A. Zlenko, Department of high matematics of Moscow automobile and road construction state technical university (MADI), Moscow, Russia.

CL-6. ID-35. SOME DYNAMICAL PROBLEMS FOR A PARTICLE TETHERED TO A RIGID BODY, Alexander V. Rodnikov<sup>1</sup>,<sup>1</sup> Bauman Moscow State Technical University, Moscow, Russia.

CL-7. ID-37. THE DEFINITION OF OPTIMAL MASS OF LOADER WITH A STOCHASTIC MODEL OF WORKING PARAMETERS, I. Ryabicova, Department of descriptive geometry of Moscow automobile and road construction state technical university (MADI), Moscow, Russia,

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#### CL-8. ID-66. ELEMENTS OF MODIFICATIONS AND SENSITIVITY OF DYNAMIC PARAMETERS, Nataša Trišović, Faculty of Mechanical Engineering, Belgrade, Serbia.

**CL-10. ID-12. ON STABILITY OF SINGULAR TIME DELAY SYSTEMS OVER THE FINITE TIME INTERVAL: CLASSICAL AND LMI APPROACH, D. Lj. Debeljkovic<sup>1</sup>,** S. B. Stojanovic<sup>2</sup>, G. V. Simeunovic<sup>1</sup>, N. J. Dimitrijevic<sup>1</sup>, <sup>1</sup> Faculty of Mechanical Engineering, University of Belgrade, Kraljice Marije 16, 11120 Belgrade, <sup>2</sup>Faculty of Technology, University of Nis, Leskovac, Serbia.

**CL-11. ID-16. MATHEMATICAL MODEL OF AERIAL ROBOTS AS THE BASIS FOR NEW RESEARCH, M. Filipovic**<sup>1</sup>,<sup>1</sup> Mihajlo Pupin Institute, The University of Belgrade, Volgina 15, 11060 Belgrade, Serbia, e-mails: mirjana.filipovic@pupin.rs

**CL-12. ID-11. PRECISE TRAJECTORY TRACKING OF ROBOTIC MECHANISM, Lj. Kevac<sup>1</sup>,** M. Filipović<sup>2</sup>, <sup>1</sup> School of Electrical Engineering, The University of Belgrade, Belgrade, <sup>2</sup> Mihajlo Pupin Institute, The University of Belgrade, Belgrade.

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#### October 3, 2012 at 8,30h-09,40 h, Contributed Lectures

**Chairs:** I. Ryabicova, Ljiljana Kolar-Anić and V. Dragičević.

**CL-16. ID-10, REGRESION AND WEIBULL ANALYSIS OF CROPPING PRACTICES IN CHANGING CLIMATE, V. Dragičević,** Ž. Videnović, B.Kresović, M. Simić, Z. Dumanović, I. Spasojević, <sup>1</sup> Maize Research Institute "Zemun Polje", Serbia.

CL17. ID-20. THE COMPARATIVE ANALYSIS OF NONLINEAR ALGORITHMS FOR TWO TANK SYSTEM CONTROL, A. Ćosić, M. Šušić, Mihajlo Pupin Institute, Robotics Laboratory, The University of Belgrade, Belgrade, Serbia,

CL-18. ID-23. H<sub>2</sub> AND H<sub> $\infty$ </sub> BASED OPTIMAL PLACEMENT OF ACTUATORS AND SENSORS FOR ACTIVE VIBRATION CONTROL, Tamara Nestorović, **Miroslav Trajkov**, Institute of Computational Engineering, Mechanics of Adaptive Systems, Ruhr-Universität Bochum, Germany

#### October 3, 2012 at 9,45h-10,25 h, Plenary Lecture

Chairs: A. Markeev and Dragutin Debeljković.

PL-7. ID-25. MODERN CONCEPTS OF ACTIVELY CONTROLLED SMART STRUCTURES – AN OVERALL DESIGN APPROACH, Tamara Nestorović, Institute of Computational Engineering, Mechanics of Adaptive Systems, Ruhr-Universität Bochum, Universitätsstr. 150, D-44801 Bochum, Germany

#### October 3, 2012 at 10,30h-11,10h, Plenary Lecture

Chairs: E. Grebenikov, Zekovic N. Dragomir and Nataša Trišovićć

#### PL-8. ID-50. WAVE PROPAGATION IN FIBRE REINFORCED COMPOSITE LAMINATES

**D. Milosavljević, G. Bogdanović** Faculty of Engineering The University of Kragujevac, Sestre Janjić 6, 34000 Kragujevac, Serbia

Break 11,10h-11,30h

#### October 3, 2012 at 11,30h-12,10h, Plenary Lecture

Chairs: E. Grebenikov, Zekovic N. Dragomir and Nataša Trišovićć

PL- 9. ID-28. SOME PROBLEMS OF DYNAMICS OF A HEAVY RIGID BODY CARRYING A MATERIAL POINT, A. Markeev, Ishlinski Institute for Problems in Mechanics of the Russian Academy of Sciences, Moscow, Russia.

Break 12,10-12,40h

#### October 3, 2012 at 12,40h-13,20h, Plenary Lectures

Chairs: A. Markeev, Zekovic N. Dragomir and Ljiljana Kolar-Anić

PL-10. ID-69. ONE APPLICATION OF REGULARLY VARYING FUNCTIONS TO FRIEDMANN EQUATIONS, Žarko Mijajlović, University of Belgrade – Faculty of Mathematics, Belgrade, Serbia

#### October 3, 2012 at 13,20h-15,00h, Contributed Lectures

#### Chairs: Tamara Nestorović, Ivana Atanasovska and Marinko Ugrčić

**CL-19. ID-26. OPTIMAL PLACEMENT OF PIEZOELECTRIC ACTUATORS AND SENSORS FOR SMART STRUCTURES USING GENETIC ALGORITHM, Seyed Mehdi Garmabi**<sup>1</sup>, Miroslav Trajkov <sup>2</sup> and Tamara Nestorović <sup>3</sup>, <sup>1, 2, 3</sup> Institute of Computational Engineering, Mechanics of Adaptive Systems, Ruhr-Universität Bochum, Universitätsstr. Bochum, Germany

**CL-20, ID-29. FURTHER RESULTS ON MODELING OF BIOIMPEDANCE OF THE HUMAN SKIN: CALCULUS OF NON-INTEGER ORDER APPROACH, M. Lazarević**<sup>1,2</sup>, Z.Vosika,PhD<sup>2</sup>, G. Lazović<sup>3</sup>, J Simić-Krstić<sup>2</sup>, D. Koruga<sup>2</sup>, <sup>1</sup> Department of Mechanics,<sup>2</sup> Module of Biomedical Engineering, Faculty of Mechanical Engineering, <sup>2</sup>The University of Belgrade, <sup>3</sup> Department of Mathematics, Faculty of Mechanical Engineering,

CL-21. ID-2. DYNAMICS OF GEAR-PAIR SYSTEMS WITH PERIODIC VARYING MESH STIFFNESS - SPUR GEARS VS HELICAL GEARS, I. Atanasovska, M. Vukšić Popović, Institute Kirilo Savić, Belgrade, Serbia.

CL-22. ID. 4. FINITE ELEMENT MODELING OF WINDSHIELD- AND WING-BIRD STRIKES, M. Ugrčić, Economics Institute, Belgrade, Serbia.

CL-23. ID-19. THE POTENTIAL ROLE OF BULK WATER IN BRAY–LIEBHAFSKY OSCILLATORY REACTION, D. Stanisavljev, M. Milenković, Faculty of physical chemistry, The University of Belgrade, Studentski trg 12-16, 11000 Belgrade, Serbia

#### Break 15,00-16,30h

#### October 3, 2012 at 16,30h-19,10h, Contributed Lectures - Special Session

**Chairs:** Ž. Čupić, Ana Ivanović-Šašić and S. Anić

**CL-24. ID-31. APPLICATION OF NON-LINEAR FREQUENCY RESPONSE METHOD FOR INVESTIGATION OF PERIODICALLY OPERATED CHEMICAL REACTORS, D. Nikolic Paunic<sup>1</sup>**, M. Petkovska<sup>2</sup>, <sup>1</sup> Institute of Chemistry, Technology and Metallurgy, The University of Belgrade, Belgrade, <sup>2</sup> Faculty of Technology and Metallurgy, Department of Chemical Engineering, The University of Belgrade, Belgrade.

CL-25. ID-38. APPLICATION OF NONLINEAR FREQUENCY RESPONSE METHOD FOR INVESTIGATION OF GAS ADSORPTION, D. Brzić, M. Petkovska, Faculty of Technology and Metallurgy, University of Belgrade, Belgrade

**CL-26. ID-40. NUMERICAL EVIDENCE OF COMPLEX NONLINEAR PHENOMENA OF THE BELOUSOV–ZHABOTINSKY OSCILLATORY REACTION UNDER BATCH CONDITIONS, S. M. Blagojevi**ć<sup>1</sup>, S. N. Blagojević<sup>2</sup> and S. Anić<sup>3</sup>, <sup>1</sup>Faculty of Pharmacy, University of Belgrade, Belgrade, <sup>2</sup>Institute of General and Physical chemistry, Belgrade, <sup>3</sup>Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia

**CL-27. ID-41. BIFURCATION ANALYSIS OF THE OSCILLATORY REGION OF A HYPOTHALAMIC-PITUITARY (HPA) AXIS MODEL, S. Maćešić<sup>1</sup>,** V. M. Marković<sup>1</sup>, A. Ivanović-Šašić<sup>2</sup>, Ž. Čupić<sup>2</sup> and Lj. Kolar-Anić<sup>1</sup>, <sup>1</sup>Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia , <sup>2</sup>Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Department of Catalysis and Chemical Engineering, Belgrade, Serbia.

**CL-28. ID-42. A NEW STRUCTURE OF CHAOS IN THE BRAY LIEBHAFSKY OSCILLATORY REACTION, Ana Ivanović-Šašić<sup>1</sup>**, Vladimir Marković<sup>2</sup>, Željko Čupić<sup>1</sup>, Ljiljana Kolar-Anić<sup>2</sup>, Slobodan Anić<sup>1</sup>, <sup>1</sup>Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Department of Catalysis and Chemical Engineering, Njegoševa 12, 11000 Belgrade, Serbia, <sup>2</sup>Faculty of Physical Chemistry, University of Belgrade, Studentski trg 12-16, 11000 Belgrade, Serbia.

**CL-29. ID-43. QUALITATIVE AND QUANTITATIVE ANALYSIS OF THE CHAOTIC SEQUENCE IN THE BRAY-LIEBHAFSY REACTION, Ana Ivanović-Šašić<sup>1</sup>,** Marija Janković<sup>2</sup>, Stevan Blagojević<sup>3</sup> and Nataša Pejić<sup>4</sup>, <sup>1</sup>*I*nstitute of Chemistry, Technology and Metallurgy, University of Belgrade, Department of Catalysis and Chemical Engineering, Belgrade, Serbia, <sup>2</sup>University of Belgrade, Institute Vinča, Radiation and Environmental Protection Department, Belgrade, Serbia , <sup>3</sup>Departmant of Electrochemistry, Institute of General and Physical Chemistry, Belgrade, Serbia, <sup>4</sup>Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia.

**CL-30. ID-44. BRAY-LIEBHAFSKY REACTION. DYNAMIC STATES WHEN TEMPERATURE IS THE CONTROL PARAMETER, J. Maksimovć<sup>1</sup>**, M. Milenković<sup>1</sup>, N. Pejić<sup>2</sup>, D. Stanisavljev<sup>1</sup>, S. Anić<sup>3</sup>, <sup>1</sup>

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Faculty of Physical Chemistry, University of Belgrade, Belgrade, <sup>2</sup>Faculty of Pharmacy, University of Belgrade, Belgrade, <sup>3</sup>IChTM – Department of Catalysis and Chemical Engineering, Belgrade.

**CL-31. ID-45. HYPOTHALAMIC-PITUITARY-ADRENAL (HPA) AXIS AS NONLINEAR SYSTEM WITH FEEDBACK, Lj. Kolar-Anić<sup>1</sup>**, Ž. Čupić<sup>2</sup>, S. Jelić<sup>3</sup>, V. Marković<sup>1</sup>, S. Maćešić<sup>1</sup>, V. Vukojević<sup>4</sup>, <sup>1</sup>Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia, <sup>2</sup> Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Center of Catalysis and Chemical Engineering, Belgrade, Serbia, <sup>3</sup> Department of Theoretical Physics and Physics of Condensed Matter 020/2, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia, <sup>4</sup> Department of Clinical Neuroscience, Karolinska Institutet, CMM L8:01, 17176 Stockholm, Sweden

**CL-32. ID-46.STOHASTIC ANALYSIS OF MONOLAYER GAS ADSORPTION: THE USE OF BI-VARIATE AND MONOVARIATE PROBABILITY GENERATING FUNCTION, O. Jakšić<sup>1</sup>,** Z. Jakšić<sup>1</sup>, D. Ranđelović<sup>1</sup>, Lj. Kolar-Anić<sup>2</sup>, <sup>1</sup> Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, Serbia, <sup>2</sup> Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia.

\* \* \* \* \*

#### October 4, 2012 at 8,30h-09,40 h, Contributed Lectures

Chairs: Ž. Čupić, Ana Ivanović-Šašić and S. Anić

**CL-33. ID-47. ANALYSIS OF REAL SAMPLES BY PERTURBATION OF NON-EQUILIBRIUM STATIONARY STATES IN AN OSCILLATING REACTION, N. Pejić<sup>1</sup>, S.** Anić<sup>3</sup>, J. Maksimović<sup>2</sup>, N. Sarap<sup>3</sup>, <sup>1</sup>Faculty of Pharmacy, University of Belgrade, Vojvode Stepe 450, 11000 Belgrade, Serbia, <sup>2</sup>Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia, <sup>3</sup>IHTM, University of Belgrade – Department of Catalysis and Chemical Engineering, Belgrade, Serbia, <sup>4</sup>Institute of Nuclear Science Vinča, Radiation and Environmental Protection Department, University of Belgrade, Serbia

CL-34. ID-48. EMULSIONS AND DOUBLE EMULSIONS AS PARTICULAR EXAMPLES OF MEMRISTIVE SYSTEMS, A.M. Spasic, Institute for Technology of Nuclear and Other Mineral Raw Materials, Dept. of Chem.Engng. Belgrade, Serbia.

**CL-35. ID-75. TYPES OF BIFURCATION POINTS IN BRAY-LIEBHAFSKY OSCILLATORY REACTION, B. Stanković<sup>1</sup>,** Ž. Čupić<sup>2</sup> and Lj. Kolar-Anić<sup>1</sup>, <sup>1</sup>Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia, <sup>2</sup>Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Department of Catalysis and Chemical Engineering, Belgrade, Serbia.

#### October 4, 2012 at 9,45h-10,25 h, Plenary Lecture

Chairs: Albert Luo, Mihailo Lazarević and K. (Stevanović) Hedrih

PL-6. ID-18. CHAOS IN MULTIPLE-TIME-SCALE DYNAMICS OF THE BRAY-LIEBHAFSKY OSCILLATORY REACTION, Ž. Čupić<sup>1</sup> and Lj. Kolar-Anić<sup>2, 1</sup> Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Center of Catalysis and Chemical Engineering, Belgrade, Serbia, <sup>2</sup> Faculty of Physical Chemistry, University of Belgrade, Serbia

#### October 4, 2012 at 10,30h-11,10h, Special Presentation

Chairs: Tamara Nestorović, Ljiljana Kolar-Anić and Stevan Maksimović

SL-1. ID-70. DIGITIZATION OF SCIENTIFIC AND CULTURAL HERITAGE IN SERBIA,

Žarko Mijajlović, University of Belgrade – Faculty of Mathematics, Belgrade, Serbia

Break 11,10h-12,00h

#### October 4, 2012 at 12,00h-12,40h, Contributed Lectures

Chairs: Alexander V. Rodnikov, Šefik M.Bajmak and Srdjan Jović.

CL-49. ID-61. COMPARATIVE ANALYSIS OF OPTIMAL SIZE WITH THE RESULTS EJECTORS EXPERIMENTAL EJECTORS TESTED IN DISTRICT HETING, Šefik M.Bajmak, University of Pristine, Faculty of Technical Sciences

CL-50. ID-68. NUMERICAL EVIDENCE OF COMPLEX NONLINEAR PHENOMENA OF THE BRAY-LIEBHAFSKY OSCILLATORY REACTION UNDER CSTR CONDITIONS, S. N. Blagojević<sup>1</sup>, S. M. Blagojević<sup>2</sup>, Ž. Čupić<sup>3</sup>, <sup>1</sup>Institute of General and Physical chemistry, Belgrade, <sup>2</sup>Faculty of Pharmacy, University of Belgrade, Belgrade, <sup>3</sup>IChTM –Department of Catalysis and Chemical Engineering, Njegoševa 12, Belgrade

#### Break 12,50-13,00h

#### October 4, 2012 at 13,00h-13,40h, Round Table

**Invitataion for Chairs and Contribytion Discussions:** Slobodan Perović, Jaroslav Labat, Zoran Marković, Živorad Čekovićć, Hiroshi Yabuno, Pavel Krasilnikov, Marina V. Shitikova, Gradimir Milovanović, Žarko Mijajlović, K. (Stevanović) Hedrih.

Round Table: "Ethic of Scientists and Evaluation of Scientific Research Results".

#### October 4, 2012 at 13,40h-15,00h, Contributed Lectures

Chairs: Srdjan Jović, Ljiljana Veljović and Julijana D. Simonović

CL-36. ID-80. STOCHASTIC PARAMETRICALLY EXCITED HEREDITARY SANDWICH MULTI BEAM DYNAMICAL SYSTEMS, K. (Stevanović) Hedrih' Mathematical Institute SANU, Department of Mechanics, and Faculty of Mechanical Engineering University of Niš, Serbia.

**CL-37. ID-79. HYBRID SYSTEM DYNAMICS ON LAYER WITH NONLINEAR ELASTIC AND INERTIA PROPERTIES,** K. (Stevanović) Hedrih <sup>1</sup>, M. Stamenković <sup>2</sup>, N. Nešić <sup>2</sup>, <sup>1</sup> Mathematical Institute SANU, Department of Mechanics, and Faculty of Mechanical Engineering University of Niš, Serbia,<sup>2</sup> Mathematical Institute SANU, Department of Mechanics, Kneza Mihaila 36/III, Serbia,

CL-38. ID-22. SYSTEM OF DOUBLE THIN PLATES CONNECTED WITH LAYER OF ROLLING VISCO-ELASTIC NONLINEAR PROPERTIES, Julijana D. Simonović, Faculty of Mechanical Engineering, University of Niš, Niš, Serbia.

CL-39. ID-78. FORCED OSCILLATIONS OF A MEMBRANE ON NONLINEAR ELASTIC FOUNDATION, Nikola Nešić, Mathematical Institute SANU, Department of Mechanics, Belgrade, Serbia,

#### Break 15,00-16,30h

#### October 4, 2012 at 16,30h-19,10h, Contributed Lectures

Chairs: Srdjan Jović, Ljiljana Veljović and Julijana D. Simonović

CL-40. ID-59. VIBRO-IMPACT SYSTEM BASED ON OSCILLATOR WITH TWO HEAVY MASS PARTICLES ALONG HORIZONTAL ROUGH LINE, Srdjan Jović, Vladimir Raičević, Faculty of Technical Sciences, Kosovska Mitrovica, University of Priština- Kosovska Mitrovica, Serbia.

CL-41. ID-71. THE PHASE PORTRAIT OF THE VIBRO-IMPACT SYSTEM BASED ON OSCILLATOR, WITH THREE HEAVY MASS PARTICLES MOVING ALONG A ROUGH CIRCLE, Srdjan Jović, Vladimir Raičević, Faculty of Technical Sciences, Kosovska Mitrovica, University of Priština-Kosovska Mitrovica, Serbia,

CL-42, ID-39. ANALYSIS OF A RIGID BODY ROTATION AROUND TWO NO INTERSECTING AXES – VECTOR METHOD AND PARAMETER ANALYSIS OF PHASE TRAJECTORIES, Ljiljana Veljović, Faculty of Mechanical Engineering University of Kragujevac, Kragujevac, Serbia.

CL-43. ID-33. THREE-PARAMETRIC TESTING OF SINGULARITY AND POSITION OF NON-LINEAR DYNAMICS RELATIVE BALANCE OF HEAVY MATERIAL PARTICLE ON ECCENTRICALLY ROTATING SMOOTH CIRCLE LINE, Marija Stamenković\*, Marija Mikić\*\*, \*Mathematical Institute SANU, Department of Mechanics, Belgrade, Serbia,\*\*Mathematical Institute SANU, Department of Mechanics, Belgrade, Serbia,and Faculty of Mathematics, Belgrade, Serbia.

**CL-44. ID-49. OPTIMAL DESIGN OF THIN-WALLED AIRCRAFT STRUCTURES USING TWO-LEVEL OPTIMIZATION APPROACH, S. Maksimovic<sup>1</sup>,** K. Maksimovic<sup>2</sup> I. Vasovic<sup>3</sup>, <sup>1</sup> Military Technical Institute, Belgrade, Serbia, <sup>2</sup>Republic Serbia, City Administration of City of Belgrade, Secretariat for Utilities and Housing Services Water Management, Belgrade, Serbia, <sup>3</sup> Institute Goša, Milana Rakica 35, Belgrade, Serbia

**CL-45. ID-18. OPTIMIZATION OF SANDWICH PLATES WITH PRISMATIC CORES, J. Djoković<sup>1</sup>,** K.Veljković<sup>2</sup>, <sup>1</sup>Technical Faculty of Bor, University of Belgrade, Serbia, <sup>2</sup>Polytechnical school Kragujevac, Kragujevac, Serbia

CL-46. ID-76. NONLINEAR FREE VIBRATIONS OF AN ELASTICALLY CONNECTED CIRCULAR

CL-47. ID-77. NONLINEAR FORCED VIBRATIONS OF AN ELASTICALLY CONNECTED CIRCULAR DOUBLE-MEMBRANE COMPOUND SYSTEM, Danilo Karličić, Milan Cajić ,Mathematical Institute SANU, Department of Mechanics. Belgrade, Serbia.

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#### October 5, 2012 at 8,30h-09,40 h, Contributed Lectures

Chairs: Stevan Maksimović and Zijah Burzić.

CL-51. ID-62. COMPATIBILITY OF ENDURANCE LIMIT AND FATIGUE CRACK GROWTH PARAMETERS IN BEHAVIOR OF WELDED JOINT OF LOW ALLOYED STEELS, Ivica Čamagić<sup>1</sup>, Zijah Burzić<sup>2</sup>, Nemanja Vasić<sup>1</sup>, Srđan Jović<sup>1</sup>, Slobodan Makragić<sup>1</sup>, Predrag Živković<sup>1,1</sup> Faculty of Technical Sciences, University of Pristina, - Kosovska Mitrovica, Serbia, <sup>2</sup> Military Institute of Techniques, 1 Ratka Resanovića Street, Belgrade, Serbia

**CL-52. ID-64. CHARACTERIZATION OF ALLOYS AND LIQUIDUS PROJECTIONS OF THE TERNARY Bi–Cu–In SYSTEM, M. Premović** and D. Minić,<sup>1</sup> The University of Pristina, Faculty of Technical Sciences, Kosovska Mitrovica, Serbia .

CL-53.ID-65. CHARACTERIZATION OF ALLOYS OF THE TERNARY Ag–Bi–Zn SYSTEM, D. Minić and M. Premović, The University of Pristina, Faculty of Technical Sciences, -Kosovska Mitrovica, Serbia

#### October 5, 2012 at 9,45h-10,25 h, Plenary Lecture

Chairs: H. Yabuno, Pavel Krasilnikov and Marina V. Shitikova

PL-12. PL-11. IF-14. HOMOGRAPHICAL SOLUTIONS OF HAMILTONIAN SYSTEMS AND COMPUTER ALGEBRA, E. Grebenikov<sup>1</sup>, N. Zemtsova<sup>2</sup>, Institution of Russian Academy of Sciences Dorodnicyn Computing Centre of RAS, Moscow, Russia

#### October 5, 2012 at 10,30h-11,10h, Contributed Lectures

**Chairs:** Stevan Maksimović and Zijah Burzić.

CL-54. ID-63. HIGH- TECH ARCHITECTURE AND SYNONYMS FOR A PREFABRICATED MODEL, Julija Aleksić, Faculty of Technical Sciences, Kosovska Mitrovica, University of Priština - Kosovska Mitrovica, Serbia.

CL-55. ID-24. EXPERIMENTAL DEMONSTRATION OF HOMOCLIC CHAOS AND MIXED-MODE OSCILLATION, Syamal K.Dana, S.Chakraborty Central Instrumentation, CSIR-Indian Institute of Chemical Biology Jadavpur, Kolkata 700032, India e-mail: <a href="mailto:syamaldana@gmail.com/">syamaldana@gmail.com/</a>

**CL- 56. ID-83.. METHODS OF RELIABILITY ASSESSMENT OF DAMAGED PIPELINE CORROSIO, Živče Šarkoćević<sup>1</sup>, Miodrag Arsić<sup>2</sup>, Srdjan Jović<sup>3</sup>, Dragan Lazarević<sup>1</sup>**,<sup>1</sup>High Technical School of Professional Studies, Zvečan, Serbia, <sup>2</sup>Institute for Testing of Materials (IMS), Belgrade, Serbia, <sup>3</sup> Faculty of Technical Sciences, Kosovska Mitrovica, University of Priština, Serbia,

#### Break 11,30h-12,00h

#### October 5, 2012 at 12,00h-12,40h, Plenary Lecture

Chairs: H. Yabuno, Pavel Krasilnikov and Marina V. Shitikova

#### PL-13. ID-81. PHENOMENOLOGICAL MAPPING AND MATHEMATICAL ANALOGY IN

**NONLINEAR DYNAMICAL SYSTEMS, K. (Stevanović) Hedrih**<sup>1,1</sup> Mathematical Institute SANU, Department of Mechanics, and Faculty of Mechanical Engineering University of Niš, Serbia,

#### October 5, 2012 at 12,40h-13,20h

**Chairs:** H. Yabuno, Albert Luo, Pavel Krasilnikov, Marina V. Shitikova, K. (Stevanović) Hedrih and Žarko Mijajlović.

Closing ceremony – Future in Nonlinear dynamics

Symposium Nonlinear Dynamics – Milutin Milanković

Multidisciplinary and Interdisciplinary Applications (SNDMIA 2012), Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

Symposium

# Nonlinear Dynamics – Milutin Milanković

### Multidisciplinary and Interdisciplinary Applications

## (SNDMIA 2012),

Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

> Editors: Katica R. (Stevanović) HEDRIH Žarko Mijajlović

# **Booklet of Abstracts**

Symposium Nonlinear Dynamics – Milutin Milanković

Multidisciplinary and Interdisciplinary Applications (SNDMIA 2012), Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

Symposium

# Nonlinear Dynamics – Milutin Milanković

### Multidisciplinary and Interdisciplinary Applications

## (SNDMIA 2012),

Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

> Editors: Katica R. (Stevanović) HEDRIH Žarko Mijajlović

# **Plenary Lectures**

Symposium Nonlinear Dynamics – Milutin Milanković

Multidisciplinary and Interdisciplinary Applications (SNDMIA 2012), Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

Symposium

# Nonlinear Dynamics – Milutin Milanković

### Multidisciplinary and Interdisciplinary Applications

## (SNDMIA 2012),

Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

> Editors: Katica R. (Stevanović) HEDRIH Žarko Mijajlović

# **Invited Lectures**

Symposium Nonlinear Dynamics – Milutin Milanković

Multidisciplinary and Interdisciplinary Applications (SNDMIA 2012), Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

Symposium

# Nonlinear Dynamics – Milutin Milanković

### Multidisciplinary and Interdisciplinary Applications

## (SNDMIA 2012),

Belgrade, October 1-5, 2012. (Eigth Serbian Symposium in area of Non-linear Sciences)

> Editors: Katica R. (Stevanović) HEDRIH Žarko Mijajlović

# **Contributed Lectures**

with Multi and Interdisciplinary Applications, (SNDMIA 2012), Belgrade, October1-5, 2012 (Eigth Serbian Symposium in area of Non-linear Sciences)

# APPENDIX I



Venue of Symposium - Mathematical Institute SANU Ul. Knez Mihailova 36/III, Auditoria I

### The Founders of the Institute



Dr. Bilimovič Anton



Dr. Kašanin Radivoj



Dr. Gavrilović Bogdan



Dr. Milanković Milutin Muran Muran Asbert



Dr. Mišković Vojislav 13. 13. Mum Den



Dr. Saltikov Nikola



Dr. Karamata Jovan



APPENDIX II

# The 50th Anniversary Conference of the ICNO-ENOC in Rome 2011.

ICNO I	September 1961 Kiev (USSR) Chair: Mitropolsky
ICNO II	September 1962 Warsaw (Poland) Chair: Ziemba
ICNO III	May 1964 Berlin (GDR) Chair: Reißig
ICNO IV	September 1967 Prague (Czechoslovakia) Chair: Djadkov
ICNO V	August 1969 Kiev (USSR) Chair: Mitropolsky
ICNO VI	September 1972 Poznan (Poland) Chair: Ziemba
ICNO VII	September 1975 Berlin (GDR) Chair: Schmidt
ICNO VIII	September 1978 Prague (Czechoslovakia) Chair: Pust
ICNO IX	September 1981 Kiev (USSR) Chair: Mitropolsky
ICNO X	September 1984 Varna (Bulgaria) Chair: Brankov
ICNO XI	August 1987 Budapest (Hungary) Chair: Farkas
ICNO XII	September 1990 Cracow (Poland) Chair: Gutowski
ENOC I	Hamburg, August 16 - 20, 1993, Chairman Professor Edwin Kreuzer
ENOC II	Prague, September 9 - 13, 1996, Chairman Professor Ladislav Pust,
	Secretary Professor Frantisek Peterka
ENOC III	Copenhagen, August 8 - 12, 1999, Chairman Professor Hans True
ENOC IV	Moscow, August 19 - 23, 2002, Chairman Professor Klimov
ENOC V	Eindhoven, August 7 - 12, 2005, Chairman Professor Dick van Campen
ENOC VI	St. Petersburg, June 30 - July 4, 2008, Chairman Professor Alexander Fradkov
ENOC VII	Rome, July 24 - 29, 2011, Chairman Professor Giuseppe Rega
ENOC VIII	Wien 2014.





#### ICNO 1:

September 12-18, 1961, Kiev, USSR IUTAM Symposium on the Theory of Non-Linear Vibrations Academy of Sciences of the Ukrainian SSR Institute of Mathematics Chainman: Prof. Dr. Yu. Mitropolsky

Committee: N.N. Bogolyubov (USSR, Chair), M.L. Cartwright (UK), C. Hayashi (Japan), K. Klotter (USA), S. Lefschets (USA), Yu.A. Mitropolski (USSR), T. Vogel

Participants: 92 scientists from 13 countries, amongst them A.I. Lurie (USSR), A.N. Tikhonov (USSR), Yu.A. Mitropolski (USSR), M.L. Cartwright (UK), S. Lefschetz (USA), S. Smale (USA)

Booklet of Abstracts – Nonlinear Dynamics (SNDMIA 2012)



## APPENDIX III

### SYMPOSIUMS ON NONLINEAR MECHANICS IN SERBIA

Dear participants of the Sixth Symposium on Nonlinear Dynamics,

Symposium NONLINEAR DYNAMICS – Milutin Milanković, Belgrade October 2012 -НЕЛИНЕАРНА ДИНАМИКА 2012 organized by the Department of natural-mathematical sciences of Serbian Scientific Society is the eighth in Serbia in area of donlinear dynamics.

First symposium in area of Nonlinear mechanics was held in Aranđelovac in 1984 and was organized by Serbian society of mechanics. A leading scientist in the area of Nonlinear mechanics, academician RAS and NANU Yu.A. Mitropolskiy was an invited participant with a Plenary Lecture.

Symposium, entitled *Sixth International Symposium on Nonlinear Mechanics Nonlinear Sciences* and Applications Niš 2003 (The 6<sup>th</sup> ISNM NSA NIŠ'2003), as was the case with the previous one, entitled 'Nonlinear Sciences at the Threshold of the Third Millenium', is organized with the wish to unite in a single symposium, on the basis of the Mathematical Phenomenology of Mihajlo Petrovic Alas, quite disparate sciences with the aim of integrating the knowledge of the participants of our symposium. This is a serious and long-term task of science.

How did it all start? It started here, at the Faculty of Mechanical Engineering, University of Niš.

Prof. dr **Danilo P. Rasković** (Ph.D. in mechanical engineering and BS in mathematics), the first head of the Chair for Mechanics and Automatics, while teaching mechanics at the Department for Mechanical Engineering at the newly founded Faculty of Technical sciences, directed his youngest and most talented students towards studying nonlinear oscillations and nonlinear mechanics. Thereafter, he initiated a cooperation with the academician **Jury Aleksejevitch Mitropolsky** and a leading school of nonlinear mechanics, asymptotic methods and nonlinear oscillations at the Institute for Mathematics in Kiev, Ukraine. That is how a centre for nonlinear mechanics was established at the Chair for Mechanics, Faculty of Mechanical Engineering in Niš. They were supported by the Institute for Mathematics – SANU from Belgrade and by the scientist from all the Universities in Yugoslavia, especially Universities in Belgrade and Novi Sad. The organization of symposiums on nonlinear sciences followed.

The *first symposium on nonlinear mechanics - Nonlinear Dynamics*, organized by YUSM and Serbian Society for Mechanics, was held in Arandjelovac. Prof. Jury Aleksejevitch Mitropolskiy gave the invited plenary lecture. All the members of the Chair for Mechanics and the Chair for Hydraulic Engineering of the Faculty of Mechanical Engineering University of Niš took part in this and other symposiums; they were co-organizers as well.

The Second Yugoslav Symposium on Nonlinear Mechanics entitled: "The First Yugoslav Conference on Nonlinear Deterministic and Stochastic Processes in Dynamical Systems with Applications YCNP Niš'91", organized by the Faculty of Mechanical Engineering was held in Niš. The Chairman of the Scientific

Committee was Prof. dr V. Vujičić, while the Chairman of the Organizing Committee was Prof. Katica (Stevanović) Hedrih. Proceedings of Abstracts was printed; the papers and invited lectures which were approved were printed in the first and the following issues of the University Journal – *Facta Universitatis, new Series – Mechanics, Automatic Control and Robotics with Editor-in-Cief* Katica (Stevanović) Hedrih. This Series was the third Series, which was being published, besides the *Series Mathematics, Informatics and Electronics, and Energetics*. William Nash, Kazuyuki Yagasaki ..., gave the invited lectures, at this international symposium.

The invited plenary lectures were given by the following Yugoslav scientists: Veljko A. Vujičić, Vladan Djordjević, Ljubomir Grujić, Božidar Vujanović, and other..

Prof. *dr Slobododan Laković*, the Dean of the Faculty of Mechanical Engineering University of Niš and a member of the Organizing Committee, has significantly contributed to the success of this symposium.

The **Third Yugoslav Symposium on Nonlinear Mechanics** was held in the form of a *Minisymposium*, as a part of the *XXII Yugoslav Conference on Mechanics in Ni*š in 1995. The Faculty of Mechanical Engineering in Niš, with co-organization by the Faculty of Civil Engineering organized this Congress as well.

The Chairman of the Organizing Committee was Prof. *Katica (Stevanović) Hedrih.* The Dean of the Faculty of Mechanical Engineering, was very hospitable. Academician *Vladan Djordjević*, the President of YUSM has contributed to the successful organization of this Congress and the Minisymposium. Professors *Yu. A. Mitropolskiy, V.V. Rumyantsev, Felix Chernousko, Anatoliy Martinyuk, Valentina Filchakova, Dan Stamatiu, ... were guest at this symposium.* 

The *Fourth Symposium on Nonlinear Mechanics* was held in 1997, again in the form of a *Minisymposium*, as a part of the *XIII Yugoslav Congress on Theoretical and Applied Mechanics*. This Congress, held in the Congress Center – Zvezda in Vrnjacka Banja, was organized by the Yugoslav Society for Mechanics. The organization of this Symposium was helped by the Institute for Mathematics – SANU and the Faculty of Mechanical Engineering in Niš and in Belgrade.

The Chairman of the Scientific Committee was the academician *Nikola Hajdin*, and the Chairman of the Organizing Committee was Prof. *Katica Hedrih*. Professors Anthony Kounadis, Guiseppe Rega, Anton Baltov, Ilya Blekhman .... were guest at this symposium.

The *Fifth Symposium on Nonlinear Mechanics- Nonlinear Sciences at the Threshold of the Third Millenium* was organized with the wish for it to become a tradition and to gather the connoisseurs of nonlinear phenomenology from disparate sciences and dynamic systems and for it to become renown all over the world.

The Chairmen of the Scientific Committee were academicians *Jury A. Mitropolsky, V. M. Matrosov and V. Vujičić*, and the Chairmen of the Organizing Committee was Prof. *Katica Hedrih*. Academicians N. Hajdin, V.V. Rumyantsev and M. Prvanović and Professors D.S. Sophianopoulos, G.T.Michaltos, Ji Huan He, I. Finogenko, P.S. Krasil'nikov ..... were guests at this symposium.

The year of the Fifth Symposium was the year of the 10<sup>th</sup> Jubilante issue of the University Journal – *Facta Universitatis, new Series – Mechanics, Automatic Control and Robotics*. These symposiums and the Journal Facta Universitatis are a permanent characteristic of the University of Niš, Faculty of Mechanical Engineering in Niš and scientific achievements of Yugoslav and Serbian scientists in international relations.

Last Mini-symposia Non-linear Dynamics at Third Serbian (28th Yu) Congress on Theoretical and Applied Mechanics, Vlasina lake, Serbia, 5-8 July 2011. Between invited lecturers were Professor Subhash C. Sinha, Director, Nonlinear Systems Research Laboratory at Auburn University and Founding Editor, ASME Journal of Computational and Nonlinear Dynamics and Professor John T. Katsikadelis, President of Hellenic Society of Mechanics.

We would like to wish all participants of this Symposium a warm welcome to our country and our Serbian Scientific Society and Venue Symposia place at Mathematical Institute SANU.

We would like to welcome you, hoping that creative efforts and achievements will prevail over preemption.

Katica (Stevanović) Hedrih



Serbian Symposium on Nonlinear Mechanics, Aradjelovac, 1984; Invited Lecturer Academician RAN and NANU Yu. A. Mitropolskiy (KIEV) in Niš with Serbian Scientists





Participants of IUTAM SYMPOSIUM Non-linearity and Chaos in Engineering Dynamics UCL 1993 London UK





Invited Lecturer: Professor Willam Nash from MTI Masachusets at Yugoslav Conference on Deterministic and Stochstic Processes in Dynamical Systems with Applications Nis 1991

#### THE FIFTH YUGOSLAV SYMPOSIUM ON NONLINEAR MECHANICS -NONLINEAR SCIENCES AT THE THRESHOLD OF THE THIRD MILLENNIUM (YUSNM NIŠ '2000)

held in Niš, Yugoslavia at October 2-5, 2000. at Faculty of Mechanical Engineering, and it dedicated to the 40th Anniversary of the Faculty of Mechanical Engineering and

Faculty of Civil Engineering and Architecture, as well as to the 35th Anniversary of the University of Niš. The Symposium is organized under the patronage of the Departmentof Technical Sciences, Serbian Academy of Sciences and Arts.



Academician RAS V. Rumyantsev (Moscow, Russia) in Niš (YUSNM NIŠ '2000-October 2-5, 2000.) at Faculty of Mechanical Engineering.



Participants of

The Fifth Yugoslav Symposium on Nonlinear Mechanics -NONLINEAR SCIENCES AT THE THRESHOLD OF THE THIRD MILLENNIUM (YUSNM NIŠ '2000)

from Russia, Greece, China, Bulgaria, Rumania, Ukraine and Yugoslavia. mr D. Jovanović (Niš, YU), Professor P. Krasil'nikov (Moscow, Russia), Professor Ji Huan He mr D. Jovanović (Niš, YU), , Academician UHEAS K. Hedrih (Niš, YU), Academician SASA M. Prvanović (Belgrade, YU), Professor G. Michaltsos (Athens, Greece), Z. Vosika (Belgrade YU), Professor D. Sophianopoulos (Athens, Greece), Academician SASA N. Hajdin (Belgrade, YU), Ass. Professor P. Rajkovi ć (Niš, YU), Professor G. T. Konstantakopoulos (Athens, Greece), Academician RAS V. Rumyantsev (Moscow, Russia), Professor D. Miki či ć (Belgrade, YU), Academician ANS V.A. Vujičić,....



Participants of the 6<sup>th</sup> International Symposium on Nonlinear Mechanics Nonlinear Sciences and Applications 6<sup>th</sup> INM NSA NIŠ 2003. (in middle professor A. Vatsala –USA, V. Lakshmikanthan-prsident of IFNA, Professor Leela-USA, Professor T. Kawaguchi-presinet of Tensor Society-Japan, Professor L. Bareteu- Romania, Professor F. Peterka-Prague, J. Warminski –Lublin, Professor U. Gabbert-Magdeburg and T. Nestorovic-now Professor in Bochum... and Serbian participants )



*Participants of the* 6<sup>th</sup> International Symposium on Nonlinear Mechanics Nonlinear Sciences and Applications 6<sup>th</sup> INM NSA NIŠ 2003.



Participants of 6<sup>th</sup> INM NSA NIŠ 2003. D. Jovanović. K. (Stevanović) Hedrih (Niš), J. Warminski (Lublin), F. Peterka (Prague) and G. Rega (Roma)



6<sup>th</sup> International Symposium on Nonlinear Mechanics Nonlinear Sciences and Applications 6<sup>th</sup> INM NSA NIŠ 2003.





Last Mini-symposia Non-linear Dynamics at Third Serbian (28th Yu) Congress on Theoretical and Applied Mechanics, Vlasina lake, Serbia, 5-8 July 2011. Between invited lecturers were Professor Subhash C. Sinha, Director, Nonlinear Systems Research Laboratory at Auburn University and Founding Editor, ASME Journal of Computational and Nonlinear Dynamics and Professor John T. Katsikadelis, President of Hellenic Society of Mechanics.

# APPENDIX IV

# Chair of Mechanics Faculty of Mechanical Engineering Niš (1963-2005)



dr Ing. Dipl. Math. Danilo P. Rašković (1910-1985) The First Head of Chair of Mechanics and Automatic at Faculty of Mechanical Engineering in Niš (1963-1974)

### Prof., Dr., Eng., B.Sc. Mathematician, DANILO P. RAŠKOVIĆ.

full-professor at the Faculties of Mechanical Engineering in Belgrade, Niš, Kragujevac and Mostar, and the Faculties of Science in Belgrade and Novi Sad

Danilo Rašković, a doctor of technical sciences and mathematician with a university degree, was the founder of the first scientifically based courses of mechanics at the Faculty of Mechanical Engineering in Belgrade. He also introduced courses on the subject of resistance of material, elasticity theory, and oscillation theory all of which he taught, too. He was the author of many high-circulation textbooks of high scientific level and good mathematical foundation. He introduced vector, matrix and tensor calculus in the studies of mechanics at the Faculty of Mechanical Engineering in Belgrade and, later on, did the same at the mechanical engineering faculties in Niš, Kragujevac and Mostar. He enabled the Faculty in Belgrade, and similar schools elsewhere, to produce highly qualified and educated engineers which was one his greatest contributions. He wrote the first university textbook in Serbia on oscillation theory containing his original accomplishments in the field. He achieved considerable scientific results in the fields of elasticity theory and oscillation theory. With a good human resource base at Niš Faculty, which he had set up, he started research work into the field of nonlinear mechanics. His scientific work is important because in all of his projects he succeeded in connecting theories of elasticity and oscillation, and engineering practice. He wrote 25 university textbooks which covered the entire field of mechanics and related areas. Almost all of them had been reprinted several times, with some of them having 20 reprints. His excellent textbooks were in use on the territory of the entire former Yugoslavia, which was in tatters under the powerful influence of fascism during the Second World War.

Thanks to Professor Danilo Rašković, the faculties of mechanical engineering of Serbia, Bosnia and Herzegovina, and all the other republics of the once unified Yugoslavia, which are now separate states, produced excellent mechanical engineers. Rašković was a patriot and an honourable man. He was the recipient of the October award of the city of Niš for his contributions to the development of science at the city's university.

This distinguished scientific figure of exquisite creative energy and inspired enthusiasm, a scholar deeply attached to the Yugoslav and Serbian scientific and cultural heritage, and an exquisite pedagogue of high moral principles is in the living memory of many generations of students whom he taught how to learn and love mechanics, as a basic scientific branch of mechanical engineering either directly, through his lectures, or through his various and numerous textbooks and compilation of problems. His disciples and colleagues are glad that he had the ability to pass onto them his great enthusiasm permeated with his sincere devotion for mechanics and his exquisite scientific eagerness.

Professor Danilo P. Rašković was born in 1910, in Užice. Upon completing elementary school and six grades of high school, he graduated from the Military Academy in 1930. As an engineering military officer he enrolled in the department of mechanical and electrical engineering at the Faculty of Engineering in Belgrade, in 1933. Having graduated in 1938, he enrolled in the department of theoretical mathematics at the Faculty of Philosophy and graduated from it in 1941. As a graduate mechanical engineer he was appointed assistant section head of the Military Technical Institute in Čačak. He remained in that position during 1941. In 1942 he was appointed assistant at the Faculty of Engineering in Belgrade where he earned hid doctorate's degree in the same year, upon presenting his thesis entitled *Tangential Strains of Normally Profiled Beams*.

Professor Rašković lectured mechanics, strains of materials and oscillation theory at the faculties of mechanical engineering in Belgrade, Niš, Kragujevac, Novi Sad and Mostar, as well as at the Faculty of Science in Belgrade, Faculty of Philosophy in Novi Sad, Faculty of Electronics in Niš, and at the Military Technical College in Belgrade. More details on the research work of Professor Rašković can be found in the Belgrade University Bulletin no.75 of 1957, issued on the occasion of his appointment as a full professor at the Faculty of Mechanical Engineering in Belgrade. During his university career, he was twice elected Vice-Dean of the Faculty of Mechanical Engineering of Belgrade University. In the mechanical engineering department at the Faculty of Engineering in Niš, he lectured statistics, kinematics, dynamics, oscillation theory, resistance of material, theory of elasticity, as well as analytical mechanics, theory of nonlinear oscillations and continuum mechanics at the postgraduate level. He was the first head of the department of mechanics and automatics at the Faculty of Mechanical Engineering in Niš. He was an extremely inspired professor, scientist and practitioner much favoured among his students and respected by his colleagues both as a professor and an engineer, because he knew how to relate engineering theory to practice.

#### Project ON174001

Serbian scientific society

Professor Rašković was a very fertile writer. While still in the military service he wrote five professional papers. In the period before 1957, when he was appointed full professor, he published 26 scholarly papers. As a full professor he wrote 37 pieces of scientific work that were published in scientific journals of the Serbian Academy of Sciences and Arts, Polish Academy of Science, German Society of Mechanics ZAMM and some other foreign journals. He took part in a number of scientific meetings in the country and abroad. He reviewed papers for four leading referral journals in the world: *Applied Mechanics Review* (USA), *Mathematical Review* (USA), *Zentralblatt für Mathematik* (Germany) and *Referativnii žurnal* (Moscow). Professor Rašković was a member of several professional and scientific societies/association in the country and abroad, the GAMM being one of them. He initiated the foundation of the Yugoslav Society of Mechanics during 1952.

He wrote a considerable number of university textbooks which ran through numerous editions. Some of them still hold records as for the number of editions and copies printed within the group they belong to. In addition, he wrote a series of textbooks on the subject of mechanics for secondary technical schools, as well as a number of chapters in professional technical handbooks, mimeographed course materials and textbooks for post-secondary schools of mechanical engineering. He also wrote several textbooks for postgraduate studies.

Among the publications for postgraduate studies the following should be mentioned: Analytical Mechanics, Theory of Elasticity and Tensor Calculus.

Most of his university textbooks and publications were at the time of their first edition the only professional literature on the subject, in the Serbian language. So, his publications played an important part in spreading of the knowledge in the field of technical mechanics among students, and mechanical and other kinds of engineers in Serbia and Yugoslavia. It is particularly worth mentioning that he has interpreted all the material by the most modern mathematical apparatus and has illustrated it by numerous examples from the engineering practice. Many of the cited university publications are being reprinted even nowadays and are still used by both students of engineering and engineers themselves.

Although it has been ten years since he left us, Professor Rašković is still present among new generations of students, and engineers, through his renowned textbooks that bear the memory of his merits and which have also left an indelible imprint on the development of mechanical engineering science and practice, and on the formation of many a generation of university professors. His life and work have set an example to future generations of students educated at the University of Niš and provided them with a creative impulse. He is an everlasting paradigm and a proof of how one's deeds can outlive one's physical existence by far.

In 1962 Professor Rašković, as the head of mechanics department at the Institute of Mathematics of the Serbian Academy of Sciences and Arts, organized research work in four different study groups, each one dealing with a particular subject, which were: *Stability of motion* - supervised by Dr Veljko Vujičić, *Boundary layer theory* - supervised by Dr Victor Saljnikov, *Problems of anisotropic incompatible materials with finite strain* - supervised by Dr Rastko Stojanović and *Optimal problems of mechanics* -supervised by Prof. Dr. Danilo Rašković.

According to records from the mechanical engineering faculties in Belgrade and Niš, as well as those from the Zentralblatt's data base, he traveled abroad on several occasions in order to participate in international scientific gatherings or to expend his knowledge. In 1957 he went to Berlin to do his specialization studies with a piece of work which was published in the *Proceedings of the 20th International Congress of Applied Mechanics*. In September 1956, in Brussels, he participated in the working of the said congress. He took part in international congresses of applied mathematics and mechanics of the German society GAMM a few times: 1957 - in Hamburg and 1958 - in Saarbrücken. Also, in 1959, 1961 and 1962 he was delegate of the Yugoslav Society of Mechanics. In 1963, in Karlsruhe, he represented Mathematical Institute of the Serbian Academy of Sciences. In 1966, in Darmstadt, he "*produced a scientific statement in the field of oscillation theory*" and in 1968 in Prague, Czechoslovakia, he had a paper entitled *Second order acceleration (jerk) for the relative motion of a body expressed by a matrix method*.

He also participated, several times, in the working of the International Conference of Nonlinear Oscillation (ICNO): 1962 in Warsaw, as a delegate of the Council of Science of the People's Republic of Serbia; 1969 in Kiev; 1972 in Krakow, at the '72 ICNO.

Between the 1963/64 and 1973/74 academic years he was Head of the mechanics section of the mechanical engineering department at the Technical Faculty in Niš, while giving lectures on all subjects from the mechanics group. Simultaneously, he taught mechanics at technical faculties in Kragujevac and Mostar and, for a while, also the subject of applied mathematics at Novi Sad Faculty of Mathematics. He accepted the position in Niš after being acquitted of the duty as a lecturer at the Faculty of Mechanical Engineering in Belgrade. The said acquittal was brought in by the Faculty in Belgrade, and was registered under the no. 67/8, in January 1964. Comments on the controversial decision are left to the others. For further reference readers should look into the book (\*).

In 1974/75 he was arrested in Mostar, Bosnia-Herzegovina, and unjustly sentenced. Following the experience, he worked on new editions of his high-circulation textbooks, out of which the 10th edition of *Mechanics I* for university studies deserves a special mention as does the 15th edition of his handbook containing tables from the strength of materials. Last months of his life he spent preparing his textbook *Elasticity Theory* for publishing. It came out in 1985 but he did not live to see it.

He died, unexpectedly, on January 29, 1985 in Belgrade.



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Symposium

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