МАТЕМАТИЧКИ ИНСТИТУТ САНУ

КНЕЗА МИХАИЛА 36

11 000 БЕОГРАД

Директору МИ САНУ др Зорану Огњановићу

Председнику Научног већа МИ САНУ академику проф др Драгошу Цветковићу

НАУЧНОМ ВЕЋУ МИ САНУ

СТРУЧНИ ИЗВЕШТАЈ СА ИНТЕРНАЦИОНАЛНЕ НАУЧНЕ КОНФЕРЕНЦИЈЕ *ESMC 2018- 10th European Solid Mechanics Conference,* која се одржала у Болоњи, Италија, од 02.-06. јула 2018. године, у организацији Европског друштва за механику, Универзитета у Болоњи и Универзитета у Тренту

Поштовани,

У периоду од 01.07.-07.07.2018 учествовала сам на интерционаналној научној конференцији *ESMC 2018- 10th European Solid Mechanics Conference,* која се одржала у Болоњи, Италија, од 02.-06. јула 2018. године, у организацији Европског друштва за механику, Универзитета у Болоњи и Универзитета у Тренту, на којој сам усмено излагала рад под насловом „***Resonant frequencies of mouse chromosomes trough mechanical oscillatory model of mitotic spindle" (ID 226)*** у оквиру секције из Биомеханике, 02. јула одмах након пленарног предавања прва у секцији. ***ESMC*** је једна од четири велике конференције које организује Европско друштво за механику и организује се сваке треће године. Излагање на овом научном скупу реализовано је у склопу активности на пројекту ОИ 174001.

Било је укупно једно опште предавање, 5 пленарних предавања, 55 минисимпозијума, 9 општих секција, 20 паралелних сесија, 136 организатора минисимпозијума, прихваћено је 1136 апстраката од 1353 пријављених, 1111 усмених излагања, 25 постера. Највећи број учесника био је из Кине, Француске, Немачке и Италије. Биле су заступљене све европске земље као и Индија, Либан, Ирак, Мароко, Аустралија, Јапан, САД, Канда, Чиле, Аргентина , Бразил...

На конференцији су биле заступљене следеће области:

Mechanics and Physics of Solids and Structures, Advances in Analytical and Discretization Methods for Discontinuities and Singularities, Mechanics of Materials, Nonlinear Elasticity, Fatigue and Tribology, Symposium Honouring Professor Norman Fleck on the Occasion of his 60th Birthday, Multiscale Modelling of Polycrystalline Materials, Micro and Nano Mechanics Systems, Homogenization Strategies for Multiphase and Active Materials, Architected Materials, Structural Analysis of Real Historic Buildings, Instabilities in Structural Mechanics and Fluid-Structure Interactions, Biomechanics, Cell Mechanics, Experimental Mechanics, Advanced Strategies for Computational Modelling of Material Failure, Reaction Diffusion Problems in Mechanics, Shape Memory Alloys and Related Materials - Modelling, Numerical

Algorithms and Applications, Beam, Plate and Shell Finite Elements based on non-Classical Theories of Structures, Mechanics in Energy Harvesting and Storage, Experimental Micromechanics and Nanomechanics, Recent advances in damage mechanics, Structural Mechanics (General Session), Mechanics of Textile Composite Reinforcements and Fibrous Materials, Graphene and Related Materials and Systems, Mechanics of Tensegrity Structures and Multifunctional Lattice Materials, Mechanics in energy harvesting and storage, Modelling of Additive Manufacturing Processes, Inelastic Processes in Heterogeneous Materials: Formulations, Uncertainty Quantification, Computations, Material Instabilities, The Physics of Dense Granular Media, Mechanics of Soft Biological Tissue, Modelling of Fracture in Hard and Softт materials, Elastic Metamaterials, Generalized Continua, Computational Homogenization of Nonlinear Composites, Computational Mechanics (General Session), Dynamics, Waves and Metamaterials, Modelling of Additive Manufacturing Processes, Composite Materials and Homogenization Theory, Nonlinear Dynamics in Mechanical and Structural Systems, Mechanics of Silk: from Molecules to Orb-webs.

У наставку је дат списак пленарних предавача са насловом предавања, афилијацијом предавача и контактним податцима. Наручито интересантна предавања су означена црвенм.

Пленарни предавачи:

Soft robots: where robotics meets mechanics
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Fibre dispersion moderated elasticity of soft biological tissues
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3Faculty of Engineering Science and Technology, Norwegian University of Science and Technology (NTNU), Trondheim, Norway

Modelling of strain localization in ductile materials
Odd Sture Hopperstad1, David Morin1, Lars Edvard Bryhni Dæhli1, Tore Børvik1, Ahmed Benallal2
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Chemistry of fatigue
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Solid mechanics on a chip
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опште предавање:

Dynamics of fracturing saturated porous media
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Erik van der Giessen, University of Groningen

Социјални програм је обухватао слободно поподне за обилазак града у среду 04. јула и свечану вечеру 05 јула.

Програм скупа се може видети на следећим линковима:

http://www.esmc2018.org/drupal8/

http://www.esmc2018.org/drupal8/schedule

У прилогу вам шаљем извод из програма и пар фотографија.

С Поштовањем,

Анђелка Хедрих

др Анђелка Хедрих, научни сарадник
истраживач на пројекту ОИ 174001
МИ САНУ
Кнеза Михаила 36
11 000 Београд
Србија

У Београду 12.07.2018.

ESMC 2018 BOLOGNA

UNIVERSITÀ DI TRENTO

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

ESMC 2018

10th European Solid Mechanics Conference

EUROPEAN MECHANICS SOCIETY

BOLOGNA July 2-6, 2018 | Palazzo dei Congressi

PROGRAM BOOK

GS-1 Biomechanics Morning Session

DAY: Monday

ROOM: Magenta A

TIME 11.15-13.15

CHAIR: Gabriele Greco, Sarah Johnson

226 **Resonant frequencies of mouse chromosomes trough mechanical oscillatory model of mitotic spindle**

Authors: Andjelka Hedrih, Katica (Stevanovic) Hedrih

Presenting Author: Andjelka Hedrih

354 **Stag beetle elytra sustains the external loads better using multi-layered structure**

Authors: Lakshminath Kundanati, Stefano Signetti, Himadri S. Gupta, Michele Menegon and Nicola M. Pugno

Presenting Author: Lakshminath Kundanati

784 **In silico simulation of growth and remodeling in biological tissues**

Authors: M. M. A. Peyroteo, J. Belinha, J.A.C.F. Leite Moreira, R. N. Jorge

Presenting Author: M. M. A. Peyroteo

914 **Modelling of cross-linking dynamics in actomyosin networks**

Authors: João Pedro Ferreira, Marco Parente, Renato Natal

Presenting Author: João Pedro Ferreira

1081 **Biomechanical Characterization of Thrombus Material through Experimental and Computational Analysis**

Authors: Sarah Johnson, Michael Gilvarry, Patrick McGarry, Peter McHugh

Presenting Author: Sarah Johnson

1352 **Patient-specific isogeometric analysis of thoracic aortic aneurysm**

Authors: Margherita Coda, Elena Faggiano, Michele Conti, Simone Morganti, Santi Trimarchi, Ferdinando Auricchio, Robert Leroy Taylor, Alessandro Reali

Presenting Author: Margherita Coda

Lunch 13.15 - 14.45 - 1st floor

Resonant frequencies of mouse chromosomes trough mechanical oscillatory model of mitotic spindle

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Keywords: resonant frequencies, mitotic spindle, oscillatory model.

Recently, scientists pointed out that the way chromosomes move within the cell during the cell division process could carry additional epigenetic information [1]. Using biomechanical oscillatory model of mitotic spindle [2] we recently suggest resonance as a potential mechanism for homolog chromosomes separation. According to this mechanical oscillatory model, mitotic spindle is presented as a system of coupled oscillators: one oscillatory pair consists of a centrosome, a microtubule and a related chromosome and these are interconnected with their homologous pairs. Centrosomes are presented as mass particles that represent two rheonomic centers of oscillations. We assume that rheonomic centers oscillate under single external forced frequency. Each element in the model has its mechanical counterpart. Using the biomechanical oscillatory model of mitotic spindle [2,3,4] and relevant numerical data from the literature, the numerical analysis of resonant frequencies of mouse chromosomes is presented. For each homolog chromosome pair we obtained non-linear frequency curves and identified two eigen resonant frequencies which behave differently. First resonant frequency is almost the same for all pairs of homolog chromosomes, while the second resonant frequency increases as mass of homolog chromosome decreases. The first resonant frequency is impact by the chromosome masses which are very similar to each other, while the second resonant frequency is impact both by the chromosome mass and its position in the mitotic spindle. The findings are important for understanding the process of cell division.

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References

[1] *Weise, A., Bhatt, S., Piaszinski, K., Kosyakova, N., Fan, X., Altendorf-Hofmann, A.,et al. "Chromosomes in a genome-wise order: evidence for metaphase architecture", Molecular Cytogenetics 9(36), 1-11, (2016).*

[2] *Hedrih, A., (Stevanović) Hedrih, K. "Resonance as potential mechanism for homolog chromosomes separation trough biomechanical oscillatory model of mitotic spindle", in Proceedings of The 6th International Congress of Serbian Society of Mechanics, Mountain Tara, Serbia, June 19-21, M3, pp. 1-10, (2017).*

[3] *Hedrih, A., (Stevanović) Hedrih, K. "Analysis of oscillatory motions of chromosomes during anaphase using biomechanical oscillatory model of mitotic spindle", in Proceedings of ENOC 2017, Budapest, Hungary, June 25 – 30, ID 372, pp.1-2,(2017).*

Hedrih, A., (Stevanović) Hedrih, K. "Relation between centrosome excitation and oscillatory energy of mitotic spindle in metaphase trough biomechanical oscillatory model of mitotic spindle", in Proceedings of IV International Seminar «Nonlinear Phenomenology Advances», Saint Petersburg, Russia, October 3 - 6, (2017).

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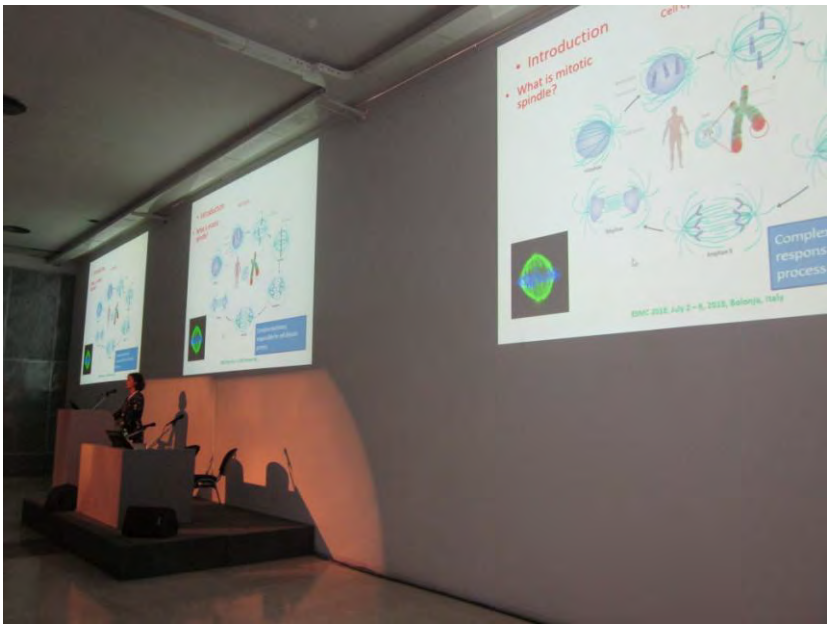
Introduction
What is mitotic spindle?


Frequency curve for first 10 chromosomes

са Fatima Mroue, Ecole Centrale de Nantes and Lebanese University EDST, Lebanon и dr Ruiz Baier Ricardo, Mathematical Institute, Oxford University, UK

са Andrii Iakovliev, Sautempthon University, UK и prof. dr Atul Baschar, Sautempton University. UK

са проф др Irina Goryacheva, *Laboratory of tribology, Ishlinsky Institute for Problems in Mechanics RAS, Moscow, Russia*