Mathematical Institute of the Serbian Academy of Sciences and Arts

Seminar

Mechanics of Machines and Mechanisms - Models and Mathematical Methods

http://www.mi.sanu.ac.rs/novi_sajt/research/seminars/mechanics_machines_mechanisms.php

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Program –mart, 2023.

Tuesday, March 14, 2023, at 17h, room 301f , Live stream Belgrade

Dr Milan Cajić, Mathematical Institute of the Serbian Academy of Sceinces and Arts, Belgrade, Serbia

RESEARCH ON MECHANICAL METAMATERIALS WITHIN THE H2020 MSCA-IF PROGRAMME

Mechanical metamaterials are artificially designed structures having unusual physical and mechanical properties that cannot be found in nature. They are often architected as periodic structures that can exhibit unique wave propagation and topological characteristics. In the last decade, there has been a growth of research on mechanical metamaterials and it is still capturing considerable attention from the scientific and engineering community as well as EU and national funding agencies. Here, we will give basic information about the MSCA Individual Fellowship programme and mention a few successful stories of Serbian applicants doing research in the field of mechanics. Some results on inerter-based topological metamaterials achieved on the METASINK project will be reviewed.

Tuesday, March 21, 2023, at 17h, Live stream Belgrade

Dr Suzana Linić, Innovation Center, Faculty of Mechanical Engineering, University of Belgrade, Serbia

SELECTED METHODS FOR APPLYING BIOMIMICRY TO HIGH-SPEED TRAIN CONCEPT DESIGN

Biomimicry as a scientific-research field, with a specific approach to the creation of useful value, methods, and systems based on the understanding of Nature, aims to improve the quality of life, preserve Nature and live in harmony with Nature. The most famous example of biomimicry of the shape of a kingfisher's beak on industrial design is the bionic high-speed train (BHST) of the Japanese railway - the Shinkansen. In the literature, for about thirty years since its creation, no description of the method of performing biomimicry has been found, one that resulted in the exceptional characteristics of BHST: reduction of noise, an increase of speed, reduction of consumed energy, and cost price. The presented biomimicry method for high-speed train aerodynamic design (BMAD) aims to offer a way to perform bird-to-train biomimicry. BMAD contains phases: acquisition of new knowledge and skills from different fields; selection and examination of biological samples; investigation of kingfisher biomechanics in diving maneuver; research of bionic 2D BHST; biomimicry of diving maneuvers - a combined method for determining the similarity of 2D flows bird - BHST; BHST 3D concept-design research and BMAD validity assessment. BMAD applies various numerical and experimental methods, some of which were developed based on biomimicry: aerodynamics (flying animals), hydrodynamics

(swimming and diving animals), part of fluid mechanics and computational fluid mechanics (flying and swimming, noise, turbulence, etc.), thermography (snake vision), rigid body mechanics (biomechanics) and 3D laser scanning (bat echolocation). BMAD, despite limited sources and resources, represents a collection of new knowledge and skills, which gave realistic results and opened up a completely new possibility of optimizing the method and design of BHST. In the design process, BMAD is compatible with known design and optimization methods. By improving BMAD, research results would become more quickly available, more precise, and more reproducible.

February 27, 2023.

The chair
dr Ivana Atanasovska,
Full Research Professor
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