Study programmes: PhD studies - Mathematics

Course name: Dynamics of the Systems of Bodies

Lecturers: Darko Milinković

Status: Optional

ECTS: 9

Attendance prerequisites: Mathematical methods of mechanics

Course aims: Examination of complex mechanical systems, construction of mathematical models and their mathematical analysis.

Course outcome: The skill of examining complex mechanical systems, the skill of making mathematical models and their solving, and the application in practice.

Course content:

Rigid-body mechanics: Equations of rotation a rigid body about a fixed point. Integrability. The Euler-Poisson case. The method of Kovalevskaya. Complex systems of rigid bodies. Applications.

Problem of several bodies: Models and qualitative analysis of the two-body problem. Models for three bodies. Critical points and closed orbits in the restricted three-body problem. Qualitative analysis of the planar n-body problem.

Mechanical systems with one-sided connections - billiards: Examples of the Birkhoff billiards. The Birkhoff theorem on periodic trajectories. Integrable billiards. Polygonal billiards.

Mechanical systems with nonholonomic connections: Equations of motion. The Lagrange–d'Alembert principle. Examples of the nonholonomic systems. Poisson geometry of nonholonomic systems.

Literature:

1. В. И. Арнольд, В. В. Козлов, А. И. Нейштадт, Современные проблемы математики. Фундаментальные направления. Математические аспекты классической и небесной механики (tom 3)
2. В. В. Козлов, Д. В. Трещев, Биллиарды. Генетическое введение в динамику систем с ударами
3. M. Audin, Spinning tops. A course on integrable systems
4. R. Abraham, J. E. Marsden, Foundations of Mechanics
5. A. Bloch, J. Baillieul, P. E. Crouch, J. E. Marsden, Nonholonomic mechanics and control

Number of hours: 10	**Lectures: 4**	**Research: 6**

Teaching and learning method: Frontal/Individual/Research

Assessment (maximal 100 points)

Course assignments	**points**	**Final exam**	**points**
Lectures	10	Written exam	30
Exercises / Tutorials	-	Oral exam	30
Colloquia	-	Written-oral exam	-
Essay / Project	30		