Study Program: Physics
Type and level of studies: Bachelor studies
Course name: Continuum mechanics
Lecturer**: Mijat Milosavljević**
Status: Elective
ECTS: 7
Attendance prerequisites: Mechanics and Thermodynamics 1, 2; Introduction to Theoretical Mechanics

Course aims

Introduction to the dynamic laws underlying the mechanics of continuous media. Acquisition of basic knowledge necessary to properly understand the phenomena and processes in continuous environments.

Course outcome

By the end of the course, the student should:

- know the basic equations of ideal fluids motion and be able to write a complete system of equations describing the deformable medium;
- understand and describe the formation of vortices, give examples of vortex formation in the earth's atmosphere and be able to account for and describe the influence of the Earth's rotation on the movement of previously formed vortices;
- know the basic dynamic equation of viscous fluids and be able to write a complete system of viscous fluid equations;
- know the basics of dimensional analysis and similarity theory;
- know the basic equations of fluid motion in a developed turbulent regime.

Course content

Theoretical part

Transition from discontinuum to continuum. The notion of an infinitesimal particle. Lagrangian-Euler method. Local and substantial derivative. Deformation tensor. The meaning of the components of the deformation velocity tensor. Strain-rate tensor. Continuity equation. Volume and surface forces. Voltage tensor. Voltage tensor symmetry. General dynamic equation of motion. The law of change in kinetic energy. The first law of thermodynamics. The second law of thermodynamics. A complete system of equations. Ideal and real fluids. Quantities that describe fluid motion. Charged ideal fluid. Basic dynamic equation of ideal fluids. Barotropic and baroclinic fluids. Different forms of Euler equation. Fluids at rest. Stationary movement. Potential movement. Vortex motion. Propagation of small wave disturbances. Supersonic flow. Shock waves. Newtonian fluids. Navier-Stokes equation. Initial and boundary conditions. Dimensional analysis and the Pi-theorem. Dimensionless equation of motion of viscous fluid. Fluid flow at large and small Reynolds number values. Elements of turbulent motion. Reynolds equations.

Practical Part:

Computational exercises are in accordance with lectures.

Literature

1. С. Стојановић, Механика флуида, Универзитет у Новом Саду, Нови Сад, 2002.
2. Л. Д. Ландау, Хидродинамика, Наука, Москва, 1986.
3. Н.Е. Кочин, И.А. Кибел, Теоретическая гидромеханика, Физматгиз, Москва, 1963.

Number of active classes				Other classes
Lectures: 2	Practical classes: 3	Other forms of teaching:		

Teaching methods

Lectures (2 classes per week during the semester), computational exercises (3 classes per week during the semester).

Assessment (maximum 100 points)			
Course assignments	**points**	Final exam	**Points**
Lectures	15	oral exam	35
Practical classes	15		35
Term tests		....	
Total	30		70