



## ***Introduction to Modelling of Multiphysics Problems***

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The course is devoted to mathematical modelling of fundamental problems of physics with an emphasis put on existing or possible multi-physics couplings. It consists of a few introductory lectures concerning relevant mathematical tools and numerical methods, as well as a series of lectures devoted to single- and multi-physics problems. The course tends also to provide a practical introduction to COMSOL Multiphysics environment.

### **Main topics:**

1. General mathematical preliminaries: Partial Differential Equations, tensor notation, integral theorems, etc.
2. Fundamentals of the Finite Element Method: the Weighted Residual Methods, the equivalence of strong and weak forms, the Ritz-Galerkin method, FEM procedure, shape functions, etc.
3. Heat transfer.
4. Elasticity and thermo-elasticity (thermo-mechanical coupling).
5. Ideal flow theory and basic aerodynamics.
6. Elementary viscous flow.
7. Waves in fluids.
8. Acoustics and vibro-acoustics (acoustic-structural coupling).
9. Piezoelectricity (electro-mechanical coupling).

**The total number of lecture hours: 30, laboratory exercises: 4 hours, self-teaching: 45, direct tutoring and consultations: 15 hours.**

**ECTS Points: 3**