Up-to date numerical simulations allow the streamlining of the designing process of machine parts and units. Optimizing mechanisms, simulations of their behaviour and other contemporary methods lead to a gradual reduction of the energy consumption of machines, reducing stress on the environment and improving their productivity.

The professional activities of the Department for Calculations and Modelling are focused on investigating research and development tasks and projects in the field of solid mechanics in the following areas:

- Research in the field of computing and mathematical modelling of physical processes
- Analyses, optimization and development of structures using the Finite Element Method (FEM)
- Evaluating deformations, stiffness and stress of components and machine units
- Static problems
- Dynamic problems – natural frequencies and shapes, excited oscillations
- Nonlinear problems, i.e., models of materials with nonlinear behaviour under mechanical stress and their verifications on the basis of experiments carried out, contact problems, large deformations
- Simulation and optimization of mechanisms
- Evaluation of responses and dynamic effects
- Research of new materials
- Modelling and experimental investigation of composite materials
- Replacement of metal machine parts with ecologically and economically more favourable composite parts

For investigating the above mentioned problems, the Department is equipped with the following software:

SW – I-DEAS, NX 7, MSC.MARC, NASTRAN, MSC.ADAMS
The mathematical modelling of physical processes in the field of fluid mechanics allows access to its own problems, especially in those cases where it is not technically possible to carry out measurements or it would be too expensive to manufacture a prototype. It also provides an effective understanding of the problem and facilitates the subsequent process of designing a new device. Simulations of flowing nowadays achieve a high level of approximation to the actual process and are closely related to the applications in engineering practice.

Other activities of the Department for Computations and Modelling is focused on solving research a development problems and projects in the field of fluid mechanics using the numerical simulations of flow:

- Numerical simulations of complex flow fields
- Compressible viscous flow computations
- Laminar and turbulent flow in a large range of speeds
- Mathematical simulations of flow with heat transfer and combustion processes
- Multiphase fluid flow and solid fraction flow drift
- Numerical simulations of the permeability of complex layers
- Development and optimization of design solutions with respect to liquids
- Calculations of the force effects of gases and liquids and interaction with the environment
- Problem solving is carried out on the latest computer systems using the Ansys Fluent® software.