

## Mathematical modeling at the junction of idea transformation into industrial products

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The article presents the ways of transforming innovative ideas into industrial products with distinct functionalities based on the application of mathematical models and modern numerical methods. The mathematical modeling of kinetostatic processes within mechanical systems allows the application of computer aided design together with complex analysis and optimizations of functional parameters, including the technical level characteristics of the finished industrial product. The computer simulation of processes based on determining the functional characteristics ensures the reduction of both financial resources and the duration of the cycle: "from idea transformation to an industrial product".

The article highlights the idea of presenting mathematical models for the description of precession gearings, taking into consideration the peculiarities of motion transformation and load transmission with spherical-spatial motion of the satellite, based on the Euler kinematic and dynamic equations. The computer simulations of the transient processes of fluid interaction with aero-hydrodynamic blades occurring in wind turbines and hydraulic rotors used for renewable energy conversion are also described. The paper outlines methods to obtain the functional characteristics and technical level parameters of both precessional transmissions with general and special destination, and the wind turbines and flow micro-hydropower plants.

**Key words.** Mathematical modeling, precession gear, aero-hydrodynamic blades, wind turbines, flow micro-hydropower plants, finite element method, Navier-Stokes equations.