BME Faculty of Mathematics

Investigation of a reduced mathematical model of a rotor blade

BSc Thesis abstract

Name: Dávid András Horváth

Supervisors:
János Lelkes, PhD student
Dr. Sándor Kovács, associate professor

Aeroelastic phenomena can often be observed in the case of thin elastic structures subjected to airflow. Aeroelastic phenomena occur when aerodynamic, inertial, and elastic forces interact with each other. At a critical flow velocity, these flexible structures lose their stability. The loss of stability of the system can cause vibrations with large amplitude or complete failure. The most famous dynamic instability in aeroelastic systems is the flutter phenomenon. During flutter oscillations, the structure is excited with the energy extracted from the flow.

In this thesis, we investigated analytical aeroelastic wing models. First, a 2-DOF model was analyzed. We nondimensionalized the governing equations and determined the wind velocity corresponding to the flutter phenomenon. We investigated the effect of the structural nonlinearities on the criticality of the Hopf bifurcation. We constructed a multi-DOF segment model of a helicopter rotor blade. We analyzed the stability of the equilibria for different configurations. Finally, the effect of the structural stiffness and damping distribution on the critical wind velocity was studied.