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Numerical Simulation of Elastic Airplane Landing Dynamics

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ABSTRACT

Numerical simulation procedures for landing dynamics of large transport aircraft are presented. Developed numerical procedures allow for determination of dynamic response of landing aircraft for different flight and touch-down parameters. Non-linear dynamical model of landing aircraft, which serves as a basis for computational procedures, is synthesized by modeling of aircraft structural subsystems using multibody dynamics approach.

The aircraft elastic wing is included in global multibody model by using floating frame of reference approach [1], whereas wing elastic displacement shape functions are determined via structural FEM code [2]. The landing gear subsystem is modeled as multibody system that includes discontinuous dynamics of oleo-pneumatic shock-absorber with friction and hydraulic/thermodynamic processes [3]. The model of non-linear tire contact dynamics is also included.

The longitudinal and lateral aerodynamic loads are estimated [4] by considering aircraft various system configurations (landing gears in up and down position, different control surfaces in active/inactive modes). For the chosen wing configuration, aerodynamic loads are also determined via computational FSI procedures, whereas spatial coupling that transfer the displacements from the elastic wing to the flow and the pressure loads from the fluid to elastic structure is applied [5]. On the basis of the reported numerical procedures, dynamic simulation of landing cases of large transport aircraft are presented.

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