SM25S_11759

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Nonlinear Vibrations of Gear Drives

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The contribution presents the original method of the mathematical modelling of the gear drive vibrations caused by internal excitation generated in gear meshings. Especially undesirable vibrations characterized by discontinuity of mesh gear can be caussed by kinematic transmission errors and time dependent meshing stiffnesses in the case of small static loading. The modal synthesis method is used for creation of the condensed nonlinear mathematical model of the whole complex system. This condensed model with smaller number DOF is constituted by means of the lower undamped vibration mode shapes of the uncoupled subsystems. The maximum and minimum meshing deformations in time and the regions of the constant mesh gear are investigated in dependence on the gear drive revolutions and static load. The condensed model is used for numerical simulation of nonlinear vibrations in phases of the mesh gear interruption. The impact motions of the gears are explained using time series, phase trajectories and Poincaré maps. The theory is applied to a simple test-gearbox.

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