# MATHEMATICAL MODELLING OF SHAFTS IN DRIVES

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**Abstract.**

Propeller shafts of drive vehicles transmit a torque at relatively large distances. The shafts are based on long and slender, and must be dimensioned not only in terms of torsional stress, but it is also necessary to monitor its resistance to lateral vibration. Due to the continuous operational area, the shafts are needed to operate in subcritical speed. Results of previous works which were also confronted with experiments showed that the propeller shafts represent strong evolutionary systems (increasing the angular velocity of rotation significantly reduce the spectrum of natural frequency relative lateral vibrations) and in practical calculations it is necessary to respect this influence. For that reason, it is not possible to model the shafts using procedures that are commonly reported in the literatura, but it is necessary to formulate a model that allows this effect respected.

Propeller shafts are in a steady state stressed by excitation bending moments harmonic, and their vectors are orthogonal to the rotating plane of a relevant fork Hooks joints. The drive torque mentioned generate in a steady state due to the transmission flow through Hooks joints and cause lateral oscillations of the propeller shafts in its rotating space. In formulating a

mathematical model, it is necessary to start from the assumption of formation relative spatial bending vibration in the shaft system $0(x, y, z)$, which rotates at an angular speed $x$. If we neglect the Coriolis force and gyroscopic moments acting on the element of the shaft, we can solve the problem in the rotating plane $0(x, y)$. The instantaneous state of the element is determined by the velocity and the angular velocities . This article aims to build a mathematical model of a coupling shaft to calculate spectral and modal properties of the connecting shaft with respect to the field of centrifugal forces that is causing the addiction of natural frequencies of bending vibrations relative to the angular velocity of the shafts rotation.

The problem is solved step by step. In the paper there is constructed by the method of physical discretization a simple model (of the solved problem), which is evident from the nature of the centrifugal force fields influence on the spectral properties of the shaft. An analytical solution of speed resonances propshafts test model (whose aim is to obtain values for verification subsequently processed models based on the transfer-matrix method and the finite element method) is performed