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Tribological dynamical damper of vibrations

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ABSTRACT

In many cases in engineering harmful effects of vibrations are suppressed by inclusion of the so called dynamic dampers of vibration [1]. They have rather a wide spectrum of application and can be used to damp various longitudinal, torsion and transversal vibrations of both machines and civil engineering constructions [2].

One of the occurring drawbacks of constructed dampers is associated with wear of contacting damper sliding bodies, which yields a change of frictional parameters and even can lead to wedging effects of a damper. The latter observation motivated us to include into the considered mathematical model of the damper the associated wear processes taking place between the contacting bodies.

In addition, the second drawback of the nowadays designed vibration dampers is associated with heat transfer to the contacting bodies yielded by frictional processes. It causes extension of the contacting bodies, and a change of contacting pressure and friction often resulting in the harmful dampers wedging effects.

In this work one degree-of-freedom system driven by either a force or a cinematic excitation is studied. An additional mass is added to the mentioned mechanical system via a special pressing device initiating dry friction occurrence on the contacting surfaces. Our proposed mathematical model of the preliminary described system includes both thermal effects and wear appeared on the contacting bodies [3]. Note that the damper geometrical properties, heat transfer between the bodies and a surrounding medium, as well as wear yield a change of friction on the contacting surface. We are focused on solution to the nonlinear problem of thermal stresses and strongly nonlinear equations governing dynamics of the investigated system. The carried out analysis yields directions for a proper construction of the mechanical vibration dampers.

[1] Giergiel J., *Damping of Mechanical Vibrations*. Warsaw, PWN, 1990 (in Polish).
[2] Osiński Z., *Theory of Vibrations*. Warsaw, PWN, 1979 (in Polish).
[3] Awrejcewicz J., Pyryev Yu., Thermoelastic contact of a rotating shaft with a rigid bush in conditions of bush wear and stick-slip movements. *Int. J. Eng. Sci.*, 40, 2002, 1113-1130.