On the periodic bush vibrations in a self-excited system with impacts

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ABSTRACT

In this work mathematical model of periodic bush vibrations in a bush-shaft self-excited system with impacts is derived and studied. The bush motion is bounded by rigid barriers and it takes place within the introduced clearance. The bush is considered as a rigid body being fixed to a foundation via massless springs and dampers, and it is mounted on the rotating with constant angular velocity thermo-elastic shaft. The bush and shaft are coupled via friction, which depends on both normal contact force and relative velocity of the moving bodies. Friction generates heat and wear on the contact surface. The so far stated problem is reduced to analysis of the equations governing bush dynamics taking into account impacts and nonlinear friction. The latter one is a product of time depended contact pressure and relative velocity of the shaft and the bush. The contact pressure value is estimated by a second order Volterra-type equation. In the case of a small slope of the kinematical friction coefficient, the restitution coefficients required to realize the system periodic impact motion either with one or two impacts are estimated analytically. The obtained prediction is verified numerically showing surprisingly good agreement. Some application oriented results are also given.