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On features of the contact model of an elastic brake shoe with a wheel

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Abstract: A mechanical system consisting of a wheel rotating around a fixed point and a brake shoe fixed by a cylindrical joint is considered. The flexibility of the shoe is modelled using a “small” body-platform, attached to the shoe by means of an elastic spring. The shoe is pressed against the wheel using a pusher device located at a point opposite to the cylindrical hinge. A constant torque is applied to the wheel. The contact between the shoe and the wheel occurs with Coulomb friction. Nonlinear equations of motion of the mechanical system are obtained. The linearised dynamic system is a system of variable structure of the 3rd order. The variability of the structure gives the system properties that are characteristic for nonlinear systems. A second-order system describing the rotation of the shoe is separated (partially?). In this system, depending on the mode of the motion, there are several special points. A numerical simulation of the dynamic system in the in the neighbourhood of singular points has been carried out in order to identify the features of the behaviour of a mechanical system. Two characteristic types of motion were found: damping of the oscillations of the shoe after the wheel stopped, and oscillations of the shoe with increasing amplitude and simultaneous “rattling” of the wheel with constant amplitude and frequency. In particular, it is shown that due to dry friction in the presence of torque, the shoe begins oscillating even from the position of static equilibrium.

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