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Previous Article Next Article

RESEARCH ARTICLE | MARCH 15 2023

Rotor dynamics with account for the eccentricity and angular error of the ball self-balancing device

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The study is devoted to the dynamics of rotors taking into account the self-balancing device (SBD). At present, the solution to the problem of dynamic balancing of an unbalanced rotor using a ball self-balancing device is relevant. In this article, a model is proposed. The equations of motion of a rotor with a ball self-balancing device are derived; the device has not only eccentricity relative to the axis of symmetry of the rotor but also has a horizontal axis of rotation. The mechanical model is based on the classic Jeffcott model. Equations of motion of the system are obtained in the form of the Lagrange equations, and conditions for the existence of stationary motions Analytical and numerical analysis of the conditions for the existence of stationary motion is performed for the case when the SBD has the eccentricity of the center and the angular error. Various possible cases of unbalanced modes, when the SBD has two or more balancing balls, are considered. In a specific case, in the absence of angular rotation, the results obtained coincide with the known results.

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