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Dynamics of MEMS Coriolis Vibrating Gyroscope with an annular disk resonator under parametric excitation

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Abstract: Dynamics of MEMS Coriolis Vibrating Gyroscope with an annular disk resonator under parametric excitation In the present work the dynamics of MEMS Coriolis Vibrating Gyroscope (CVG) with an annular disk resonator is investigated. The analytical formulation of the problem of disk free in-plane bending-mode oscillations is derived and investigated. The frequencies and modes of the disk oscillations on a fixed and rotating platforms are determined using the collocation method for boundary value problems as well as using the finite element method. Comparison of solutions with the thin ring formulation is performed. On the basis of the Hamilton variational principle, an analytical formulation of the problem of plane oscillations of a rotating disk is formulated, taking into account the assumption of the inextensibility of annular fibers of the disk. The Bryan effect is studied for an ideal disk resonator, namely, the effect of centrifugal and Coriolis inertial forces on the frequencies and modes of oscillation. An analytical discrete model of a CVG with a disk resonator is constructed. Based on well-known in literature methods of electronic restoration of an imperfect vibratory gyro to an ideal state, the dynamics of a CVG in parametric excitation regime is analyzed taking into account anisotropic viscosity of the resonator and action of Coriolis forces.

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