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Influence of Kinematic, Physical and Mechanical Structure Parameters on Aeroelastic GTU Shaft Vibrations in Magnetic Bearings

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Abstract : At present, vibrations of rotors of gas transmittal unit evade sustainable forecasting. This paper describes elastic oscillation modes in resilient supports and rotor impellers modeled during computational experiments with regard to interference in the system of gas-dynamic flow and compressor rotor. Verification of aeroelastic approach was done on model problem of interaction between supersonic jet in shock tube with deformed plate. ANSYS 15.0 engineering analysis system was used as a modeling tool of numerical simulation in this paper. Finite volume method for gas dynamics and finite elements method for assessment of the strain stress state (SSS) components were used as research methods. Rotation speed and material's elasticity modulus varied during calculations, and SSS components and gas-dynamic parameters in the dynamic system of gas-dynamic flow and compressor rotor were evaluated. The analysis of time dependence demonstrated that gas-dynamic parameters near the rotor blades oscillate at 200 Hz, and SSS parameters at the upper blade edge oscillate four times higher, i.e. with blade frequency. It has been detected that vibration amplitudes correction in the test points at magnetic bearings by aeroelasticity may correspond up to 50%, and about -π/4 for phases.

Keywords : Centrifugal compressor, aeroelasticity, interdisciplinary calculation, oscillation phase displacement, vibration, nonstationarity

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