THE INVESTIGATION OF RADIAL OSCILLATIONS OF THE CENTRIFUGAL PUMP ROTOR IN ANNULAR SEALS

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The centrifugal pumps and compressors have obtained a widespread application in industry. To a considerable degree, their technical development is defined by vibroacoustic parameters that depend on the vibrational state of the rotor.

The disk rotates on a deflection axis of a shaft with constant frequency and fluctuates with small radial and angular oscillations. The analysis of such a system with four degrees of freedom represents essential mathematical difficulties. That is why it makes a sense to research easier partial systems performing only radial or only angular oscillations. The present paper is devoted to radial oscillations that have future practical use for further investigation of joint oscillations. Joint radial-angular oscillations occur in real rotors, although the constructions of rotors, that perform mainly one kind of the oscillations, exist. Particularly, the rotor with localized mass and symmetric, dynamically stable single-disk rotor have just two degrees of freedom.

The equation of free radial oscillations with hydrodynamic forces and moments represents the system of the fourth order with real variables. Two variants of problems exist when natural frequencies are determined. The first case is when there is constant pressure drop in the seal and the second case appears when constant drop of the pressure in the seals is proportional to the square of the rotating frequency.

The determination of critical frequency of the rotation is connected with the resonance that is sharp increase of a steady-state forced oscillations amplitude when frequency ω_f of external action on the rotor is approaching any of its natural frequencies.

Amplitude-frequency and phase-frequency characteristics were formed for a testing model of the rotor for three values of conicity parameter.

Amplitude-frequency characteristics have a resonance peak under the conditions that match the conditions of critical velocities existence. In other case it increases monotonously.

The investigation in the present paper was conducted in Mathcad 14 and all of them were made analytically.

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