

VIBRATIONS OF A ROTOR SUPPORTED ON AERODYNAMIC BEARINGS AS AN EVOLUTIVE SYSTEM

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ABSTRACT

The use of air as the lubricant in bearings is advantageous, particularly in chemical and food industry, where the harmful effect of oil or other lubricants undesirably influences the properties of final products. Aerodynamic bearings belong to new progressive types of bearings with complicated stiffness and damping forces during increase of revolutions. Therefore the very detailed theoretical and experimental research has to be done before application into long-term operation.

One type of aerodynamic tilting pads bearing is developed and experimentally studied in Institute of Thermomechanics ASCR on a small model (journal diameter $d = 50$ mm, length $l = 500$ mm, mass of rotor $m_g = 7.2$ kg, revolution up to 60000 rpm) and is theoretically analyzed on mathematical model of evolutive system (grant ASCR No. S2076301).

The dynamic properties of bearings i.e. evolutive stiffness and damping matrices dependent on revolutions were ascertained by numerical solution in the Techlab s.r.o., Prague. Response curves of rotor were calculated for two cases of dynamic characteristics of bearings: *without* and *with* considering of inertia properties of tilting pads.

In the first case the elements of stiffness and damping matrices change monotonously with increasing revolutions. In the second case, the same matrix elements of system with considering inertia properties of tilting pads vary non-monotonously in a wide frequency interval. It is shown that response curves in this case are more complicated and even new resonance peaks can appear.

In addition to response curves, the spectral and modal properties of rotor supported on aerodynamic bearings are analyzed. The evolutive functions of the complex eigenvalues from the aspect of resonance vibrations and of the limit of stability motion are studied. The evolution of complex eigenvalues on the so-called component matrices of the resolvent expansion on the revolution will be presented..

The comparison of experimental and theoretically obtained results will be given as well.