

DYNAMIC CHARACTERISTICS OF ROTOR-BEARING SYSTEM WITH THE ROTOR REINFORCED BY LIGHT COATING OF COMPOSITE MATERIAL

S. M. Ghoneam*, Ph.D., S. Strzelecki**, Ph.D.

*Professor in Mechanical Design & Production Engineering Department, Faculty of Engineering, Menoufya University, Shebin-el-kom, EGYPT

**Technical University of Lodz, Institute of Machine Design, Faculty of Engineering, Stefanowskiego 1/15, 90-924, Lodz, POLAND

Phone: 48.42.6312239, Fax: 48.42.6367489, E-Mail: strzelec@pkml.p.lodz.pl

ABSTRACT

Successful design of rotor avoiding whirling speeds, vibration, and dynamic forces transmitted to the structure is necessary in modern high-speed rotating machinery. The damping criteria played an important role in the controlling vibration and dynamic behavior of high-speed rotor. It may be found in various bearing supports and rotor materials. This subject has been the aim of several researchers. One of the methods for the controlling vibration of rotating machinery was applied by using non-classical rotor materials such as the composite materials. The internal damping of hybrid laminated composite material coating of high-speed rotor has an effect on the dynamic characteristics of rotating machinery. These characteristics can be controlled by changing the coating structure. The built-in composite coating layer is dependent mainly on the fiber orientation, coating thickness, sequence of laminating coating, and volume fraction. In the presented paper, the dynamic characteristics for a shaft made from steel and coated with a glass fiber in epoxy resin has been investigated for various filament winding angle, different thickness of layer, and sequence of coating layer. A filament winding technique was applied for manufacture of the coated rotors. The FFT spectrum analyzer and finite element technique were used to obtain the experimental and theoretical results of rotor dynamic characteristics. The test results are in qualitative agreement with the theoretical. It is shown that with a suitable choice of fiber orientation and thickness of coating layer composite material for rotor may reduce the rotor vibration and instability of the system eliminated.

High-speed rotors operate mainly in the multilobe of tilting-pad journal bearings. The interaction between the coated rotor and bearings was investigated on the example of elastic rotor running in 3-lobe journal bearings. The hydrodynamic equations of lubrication were solved numerically on the assumption of turbulent, adiabatic oil film and at static equilibrium position of journal.