

# **New Theory of Rotor Dynamics: Dynamics of Vertically Suspended Rotor**

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## **ABSTRACT**

**Keywords:** Dynamics, Rotor, Unbalance, Shaft, Support

Rotors of ultracentrifuges, fans, frequently are suspended vertically. Usually, rotors have an additional elastic support. Dynamics of vertically suspended rotor has not found reflection in the scientific and technical literature.

In given article the "inertial" theory is applied to the description of dynamics of a rotor in conditions of gravitation. The forces and rotating moments enclosed to a rotor are considered for a conclusion of the equation of dynamics. Directions of action of forces and the moments also are defined and represented on the drawing. Features of dynamics of a rotor are considered in rotating system of coordinates. The new, basic equation of dynamics of a rotor is received and its analysis also is carried out.

Three ranges define features of rotation of a rotor. These ranges are considered. Formulas for calculation of parameters, forces and the moments are received for each of ranges of rotation of a rotor.

New dependence for definition of critical speed is received. Conditions at which for a disk and cylindrical rotor there is a critical speed are received. Absence of a full self-centering of a rotor is shown.

The big attention is given to definition of corners between plane of action of the main vector of disbalance and direction of displacement of a geometrical axis, and also the centre of a mass of a rotor. Also corners between the main vector of disbalance and vectors of forces are determined.

The special attention is given to rotation of a rotor without an elastic support.