New Theory of Rotor Dynamics:
Dynamics of a Rotor of "Umbrella" Type, with Elastic Support

Alexander Y. Zhivotov
Apt.148, 8, Yangel st., 49089,
Dniepropetrovsk, Ukraine
Phone: (38) (0562) 92-50-11
Fax: (38) (056) 770-01-25
E-mail: kbu@public.ua.net

Yuriy G. Zhivotov
Apt.148, 8, Yangel st., 49089,
Dniepropetrovsk, Ukraine
Phone: (38) (0562) 92-50-11
Fax: (38) (056) 770-01-25
E-mail: kbu@public.ua.net

ABSTRACT

Keywords: Dynamics, Rotor, Unbalance, Shaft, Support

Dynamics of a rotor rotating around of a motionless basic point is a classical problem of the theoretical mechanics. Differential equations Euler are usually used for the description of rotation of a rotor. However, the decision of system of the equations exists only for special cases. In a researched case the rotor has elastic support and, therefore, use of the equations Euler are not rational.

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 unbalance 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 unbalance and vectors of forces are determined.

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