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Decrease of the Weight (Levitation) of a Rotor With Horizontal Axis of Rotation

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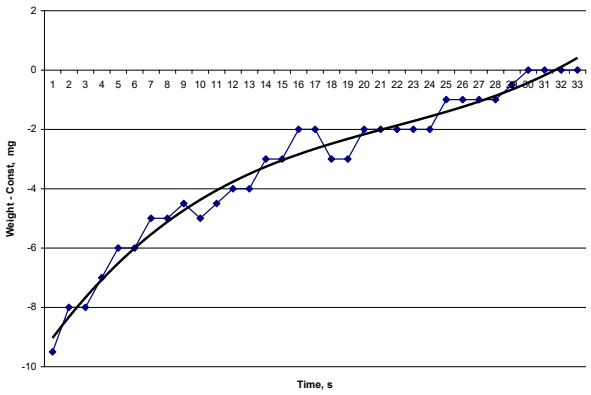
Abstract

This article outlines the results of weighing of brass rotor with horizontal axis of rotation. At frequency of rotation of 85 Hz, decrease of the weight of a 290 g rotor reaches 8-10 mg and positively correlates with elementary theory of the effect.

Keywords: weight, rotor, levitation

Possibility of decrease of the weight of a rotor with horizontal axis of rotation was stated in (Dmitriev, A. L., 2001; Dmitriev, A. L., 2008). Physical reason of such effect is being caused by difference of addition of trial mass with passing and oncoming accelerated movement of the mass, in relation to the vector of acceleration of gravity, under the affect of external elastic force. This effect may be viewed as gravitational analog of Faraday-Lentz phenomenon in electrodynamics. It is known that rotary motion of the body in vertical plain is accompanied by observed acceleration of the particles of such body.

In experiment described below, brass rotor with diameter of 52 mm and mass of 290 g is fixed in container suspended by two nylon threads in the frame of a holder, which is being placed on an electronic scales “Vesta AB 1200-1” with frequency of readings of 1mg. Magnetic-isolated (in the permalloy cover) compact electric motor connected with the rotor has been placed inside of closed, also magnetic-isolated, container and has been turned on for dispersal of the rotor for 120 sec. After dispersal the source of power was disconnected and during mass calculations of the container, rotation of the rotor was inertial. An example of temporary experimental dependency of measured mass of the container is shown on the Figure.



During rotor's run-down, frequency of its rotation showed linear decrease from 85 Hz to 30 Hz. Within the limits of accuracy of these measurements impact of rotor vibration and temperature, as well as magnetic interference, is insignificant. Frequency dependence of the change of rotor mass may be explained within the framework of elementary theory (Dmitriev, A. L., 2001; Dmitriev, A. L., 2008; Dmitriev, A. L., 2012). According to this model, outside of the area of overlap of frequency of rotor rotation and frequency of weak fluctuations of the strength of gravitational field, dependency of relative weight changes $\Delta m / m$ of continuous cylindrical rotor with radius R with horizontal axis of frequency of rotation f is described by formula:

$$\frac{\Delta m}{m} = -\alpha_{pc} \frac{8\pi R f^2}{3g}$$

where g - normal acceleration of gravity, $\alpha_{pc} = (\alpha_p - \alpha_c)$ - difference of coefficients of interaction of elastic and gravitational forces during passing (p) and oncoming (c), in relation to direction of the vector of acceleration of gravity, accelerated movements of the body.

According to previously conducted measurements of the weight of paired aviation gyroscopes, numerical value $\alpha_{pc} \approx 10^{-7}$. With rotation frequency of the rotor of 85 Hz, calculated value of the decrease of median mass of the rotor used during experiment is 4.6 mg, which is close to experimental values of weight decrease shown of the Figure. Research of frequency dependency of the weight of rotors of different sizes and mass allows us to specify numerical values of parameters f and α_{pc}, used for calculations of mass decrease, and clarify particulars of described effect of levitation.

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