On Velocity of Drive-Free Motion

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A drive-free system made on the basis of a planar mechanism is described. The experimental results on average velocities of the drive-free propulsive system are presented in a scaled view.

During usual motion, a system is repealed from the surface in the case of its motion on a plane or from the medium when it moves in a resistance medium. This kind of motion is achieved by using a drive mechanism. In contrast to the usual motion, the drive-free propulsive system moves due to interaction of a body of a system with another body of the same system. Sometimes such machines are called inertioids [1] or vibration propulsive devices [2]. To produce such kind of motion it is sufficient to provide anisotropy of the resistance force [3-5] or asymmetry of the internal force [6]. One of the simplest ways to do it is to use a simple two-link planar mechanism. A device for such a motion is shown in Fig. 1.

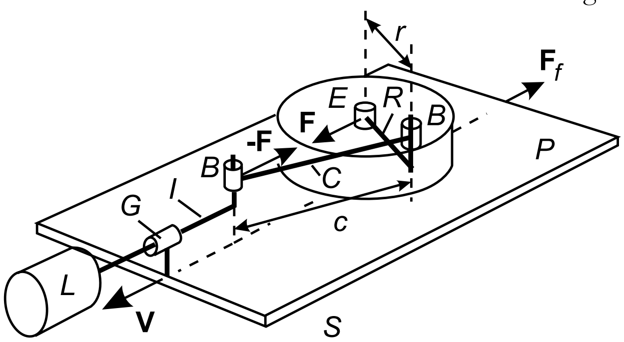

Fig. 1

Experimental device

This device with a total mass of M+m consists of a platform P on which an electric motor E rotating a drive rod R of length r is mounted. This is only one part of the planar mechanism. Another link is the connecting rod C of length c which connects the unbalanced load L and the drive rod R by means of two bell bearings B. The unbalanced load L of mass m on the rod I slides in guide G. The basic distinction of this mechanism is in that this variant of drive-free machine allows us to analyze the experimental data on average velocities of motion. Actually the only forces, which act on the platform and are collinear to the moving direction, are the force **F** caused by vibrations of the load L and the frictional force $\mathbf{F}_f$. The platform starts to move when the force acting on the platform becomes greater than the frictional force.

Let us discuss possibilities of the real propulsive system shown in Fig. 1. Measurements were made at r=0.01 m and at three mass ratios m/M. The values of frictional coefficients were measured for each parameter of the system and vary from k=0.25 to k=0.4. The system starts moving when theoretically the drift does not take place. When motion becomes reversible, the velocity of drive-free drift does not decrease.

Thus drive-free motion is possible even if the frictional coefficients are very small. When increasing the frequency of vibrations velocity does not decrease. We can not discuss the existence of some third force acting on the platform (we can suggest the existence of frictional force $\mathbf{F}_f$ and the internal force **F** caused by vibrations). Let somebody else take the liberty of making such a conclusion!

References

1. Tolchin V.N. Inertioid. // Perm: Perm Book Publisher. 1977. Blekhman I.I. Vibrational Motion. // Moscow: Nauka. 2000. Nappo F. Sulla Influenza Indiretta Delle Forze Inertne sul Moto del Baricentro. // La Ricerca Scientifica (Rendiconti). 1965. V. 8. No 1. P. 3-14.
2. Gerasimov S.A. Anisotropy of Frictional Force and Vibrational Motion. // Problems of Applied Physics. 2001. V 7. P. 85-88.
3. Gerasimov S.A. Self-Similarity of Vibrational Motion in a Resistant Medium. // Journal of Applied Mechanics and Technical Physics. 2002. V. 43. No 1. P. 90-92.
4. Gerasimov S.A. A Real Model of Vibratory-Impact Propulsive Device. // Problems of Applied Physics. 2000. V 6. P. 117-118.
5. Langhaar H. L. Dimensional Analysis and Theory of Models. // New York: Willey. 1951.