Samokhvalov V.N.

Measurement of Force Effects During Mass-dynamic Interaction

Annotation

This article presents the results of the experimental research of rotating mass force effects in vacuum having a variable quadrupole moment on solids. During the research the values of forces and moments, exciting rotation and repulsion of solids from rotating mass were measured. The mass-dynamic force which was ascertained during our experiments was approximately 2.5…2.7 N while the value of torque was about 1 N·cm. On the grounds of experimentally ascertained force effects, we can assume that a type of interaction under the condition of the presence of a relative mass movement similar to a relative electric charge movement, plays an important role in nature.

Contents

1. Introduction

In our former experiments it was ascertained that in moderate vacuum (under 0.001 Torr) rotating mass (an aluminum or a cardboard disc) force effects appear, having a variable quadrupole moment on solids which are closely located (e.g. a screen, a disc, a torsion pendulum) both made of nonmagnetic and of conductive materials – mass-dynamic interaction [1]. See: http://www.youtube.com/user/Begemotov .

The objective of set forth below series of experiments was the study of the intensity of the force mass dynamic interaction in moderate vacuum (from 0.1 to 0.0008 Torr) and the measurement of the value of occurring forces and torques.

2. Experimental equipment and tools

The experiments were carried out in the research centre of space energetics of Samara State Aero-Space University (the national research university).

Initial air exhaust was carried out by a vacuum forepump НВЗ-300 up to 0.1 Torr and then some deeper vacuum (up to 0.0008 Torr) was supplied to the chamber by a booster oil-vapor vacuum pump 2НВБМ-160. The control and the measurement in the chamber were carried out by a thermocouple vacuum gage ВТ-2А-П.

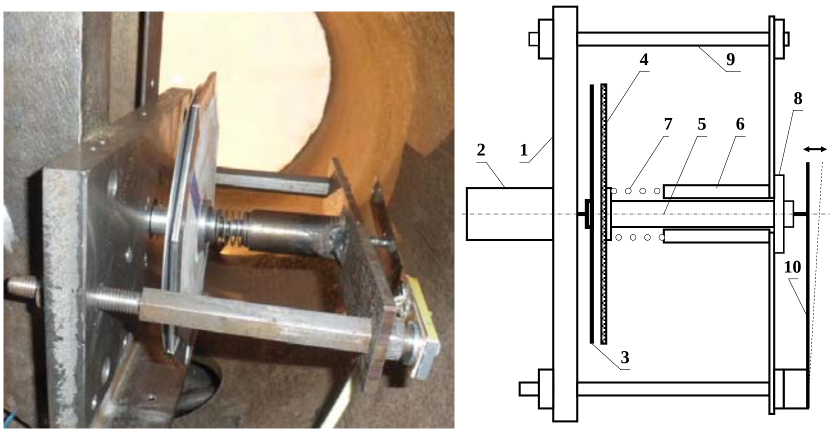
This gage includes the dynamically imbalanced disc made of aluminum alloy AMr3, with the diameter of 164 mm, the thickness of 0.9 mm, and the mass of 50 gr, being rotated by a direct current electric motor Д-14ФТ2с (U_H=27 V, n=12500 rpm. Electric motor was connected to the source of direct current supply located outside the chamber, which allowed to maintain stable preset voltage. The experimental gage was placed in thrust inside the vacuum chamber. The great thickness of the chamber walls (15 mm) and its great mass together with the rigid placement of the gage almost excluded its vibration while the disc was rotating, which had dynamic (moment) imbalance.

3. Mass-dynamic force effect on the rigid movable screen

In the next series of our experiments we measured the mass dynamic force effect on the rigid movable screen from the rotating dynamically imbalanced disc.

The gage (Fig.1.) was mounted on the frame made of steel angle pieces placed in thrust inside the vacuum chamber with the help of bolts. The steel plate (1) with the thickness of 18 mm is fixed with the bolts on the frame. The direct current electric motor Д-14ФТ2с (2) was placed on the plate. The dynamically imbalanced disc (3) made of aluminum alloy AMr3 with the diameter 162 mm, thickness of 0.9 mm, and mass of 50 gr was placed on the electric motor axis. A flat octagonal screen (4) was placed with the adjusted clearance with the disc. The screen was made of thick cardboard with the thickness of 3 mm and it was glued with aluminum foil (0.24 mm).

The screen and the axis (5) were able to move on the axis in the bush. The value of initial spring compression (7) was set with an adjusting screw (8) with a locknut using gauging relation obtained before.



a) b)

Fig.1. Gage for mass-dynamic value measurement: a – overall view, b) basic diagram

The initial distance from the screen to the disc was set for account of adjusted bar (9). The gage was supplied by a movement strain gauge (10) – resilient console-pinched plate with four strain gauges and adjusted backstop. The indication from the strain gauges when the plate bent (owing to the axial movement) was given to the strain-gauge station with a numeric millivoltmeter. A preliminary gauging of the strain gauge was carried out and we obtained the following:

1) dependence of registered by the strain-gauge station strain on the value of the screen axial movement (the gauging was carried out with the use of the detecting head);

2) dependence of the strain on the force value affecting the screen which is necessary to repel the screen (using a mechanical dynamometer, its spring gauging had been carried out with the help of МИП-1 before).

The force value during the screen axial movement was comprised of the force necessary for the spring compression (7) taking into consideration its preliminary compression (it was set as 2 N), the force necessary for resilient bend of the displacement sensor plate and friction forces between the axis and the bush.

Initially the experiments were carried out with the vacuum depth of 0.1 Torr. The initial clearance between the disc and the screen was set as approximately 3 mm, which securely excluded their mechanical contact. Under the feeding voltage of 30 V and after the disc began to rotate with up to 100…150 1/s the strain gauge indicated the screen repulsion from the disc (displacement from the initial location) to the distance of approximately 1…1.5 mm. As the force of the initial spring compression equaled 2 N, then taking into consideration gauging dependences, the repulsion force – mass dynamic force affecting the screen was in that case approximately 2.2…2.5 N.

Under the feeding voltage of 30 V and after the disc began to rotate with up to 100…150 1/s the disc forced rotation with the frequency of approximately 0.5…1.0 1/s was also excited.

The effect of the screen forced rotation excitation during non-contact mass-dynamic interaction with the rotating dynamically imbalanced disc was similar to that which had been observed during the interaction of the discs [1]. The induced torque in the screen material was sufficient for overcoming the friction force in the axis and the bush and the friction force which was produced by preliminary compressed spring in the rotating and non-rotating parts of the experimental gage being in contact.

During the "pouring" of air into the vacuum chamber to obtain atmospheric pressure without opening the chamber and resetting the gage with the same electric motor feeding voltage the force effects on the screen with the rotating disc did not occur.

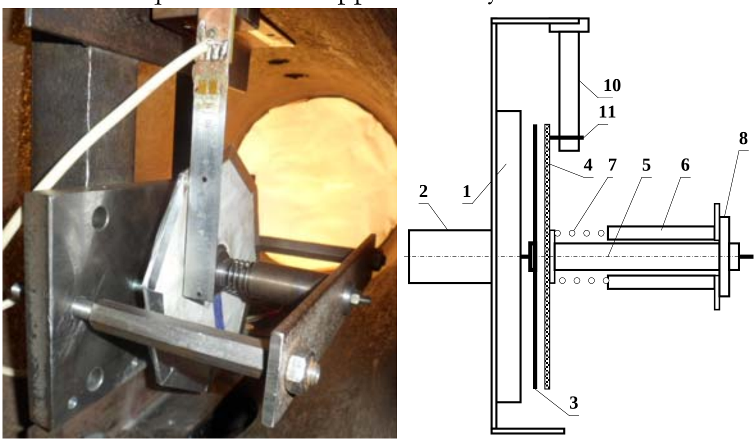
Then without resetting the gage the air pumping in the chamber was carried out up to 0.0008 Torr. With feeding voltage of 30 V after the beginning of the disc rotation up to 100…150 1/s the displacement strain gauge indicated the screen repulsion from the disc to the distance of approximately 1.5…2 mm. mas- dynamic force effect on the screen in that case equaled approximately 2.5…2.7 N. The forced rotation frequency increased up to 2…3 1/s. See:
http://www.youtube.com/watch?v=NZaZIKiUEZo

The obtained results confirm that was ascertained before, namely with the increase of the vacuum depth the mass-dynamic interaction value of the disc and the screen increase.

In order to measure the torque rotation, the same experimental gage was used, but the displacement strain gauge (10) was fixed on the gage frame in such a way that its resilient plate was in contact with a dowel (11) which was rigidly fastened with the screen (4) (Fig.2.).

During the screen turn (rotation), the torque excited by the mass-dynamic interaction was defined taking into consideration the bend value of the displacement strain gauge and the moment arm value.

The electric motor feeding voltage and the geometrical clearance between the disc and the screen remained the same (30 V and 3 mm correspondingly). As our experiments showed, under the residual pressure in the chamber of 0.1 Torr the torque value causing the screen forced rotation resulting from the mass-dynamic force effects was approximately 0.5 N ·cm. Under the residual pressure in the chamber of 0.001 Torr the torque value was approximately 1 N ·cm.



a) b)

Fig.2. Gage for measurement of mass-dynamic torque value: a – overall view, b – basic diagram

4. The explanation of force mass-dynamic interaction mechanisms

The results obtained experimentally testify that mass-dynamic forces and mass-variational (quadrupole) radiation affects any material objects irrespective of their electric properties (copper and wood). The mass-dynamic force effect has extensional nature similar to the electromagnetic force effect.

The mechanism of the disc mass-dynamic effect (in moderate vacuum) on the screen is as follows. During the rotation of dynamically imbalanced disc each point on its surface and each elemental unit of the disc material rotates on its own circumference (R_i = const), i.e. they do not have their axial movement and, correspondingly, axial acceleration. However, as far as any optional point of the space is concerned (point A,

Fig. 3) which is motionless relative to the disc mass center, where there is test mass m_T, a cyclic approach and drawing of the disc surface (disc mass m_D) determined by the disc rotation frequency ω and the value of its axial runout ΔL take place (Fig.3).

When there is a test mass in point A a relative accelerated movement of the disc mass m_D relative to the test mass m_T, takes place. That is here one should not consider the acceleration applied to the mass (as in Newton's Laws), but they should consider the acceleration of alteration of the distance (location in the space) between masses.

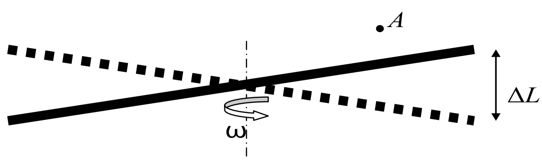


Fig.3. Relative accelerated movement of rotating dynamically imbalanced disc

Thereby, dynamical (moment) imbalance during the disc rotation (variable quadrupole moment) causes a relative accelerated movement of its mass relative to closely located masses (air molecules, screens) which excites mass-variational field, creating a mass-dynamic (spin) polarization of the matter (residual gas medium molecules, screen material molecules).

Mass-dynamic (spin) polarization of the screen material is a vector orientation of the orbital moment of the atomic (molecular) thermal motion quantity of the screen material and also atom spins relative to lines of force of the rotating disc mass-dynamic field (mechanical spin polarization). The necessary conditions for that are mass dynamic field (disc rotation) occurrence and mass-variational (quadrupole) radiation effect (disc dynamic imbalance). The consequence of that is the occurrence of force mass-dynamic interaction of the rotating dynamically imbalanced disc and the screens (discs, torsional pendulums, etc.)

a) the mechanism of the screen repulsion force occurance

As one can see in the video record of the process, the screen repulsion begins with a kind of delay after the disc begins to rotate. But then the repulsion continues even with considerable decrease of the disc rotation frequency (after its halt). This can be explained at first by a process delay of the screen material mass-dynamic polarization during the disc rotation and then by preservation of the residual polarization of the screen material during a period of time when the disc rotation frequency falls.

Qualitatively, the process of mass-dynamic force effect on the frames made of different materials was the same. But herewith, the repulsion of the heavier wire frame always started earlier than of the wooden frame (during the disc rotation), but it also stopped considerably quicker with the disc rotation frequency decrease. When the frames were placed at the same distance from the disc, the force effect on the wire steel-copper frame was evident to a greater extent (the greater frequency of vibration) than on the wooden frame. It is likely to be determined by different speed and degree of the mass-dynamic polarization of the materials with different density (in this case – cooper and wood).

Vibrational nature of the screen repulsion process under set disc rotation frequency is determined by a greater mass-dynamic force gradient – strong dependence of forces on the distance from the disc and by the decrease of normal constituent of the active mass-dynamic force with the gradient angle alteration of the screen relative to the disc.

Initially, when mass-dynamic forces reached the value exceeding the screen weight, its repulsion from the disc starts, and then owing to the impulse nature of the load application, the screen (frame) passes the part of its trajectory under its own inertia. Thereafter, under the effect of gravitational forces (and also "tab" repulsion from the gage plate – with the wire frame) the screen moves towards the disc, obtains a new impulse, and, thus, the vibration process occurs.

b) the mechanism of the screen rotation excitation

Mass-variational (quadrupole) radiation effect of the rotating dynamically imbalanced disc and its mass-dynamic field result in spin polarization of the screen material. This causes a unidirectional molecule (atom) rotation relative to the lines of force of the mass-dynamic field (their spin orientation).

The molecule (atom) spin orientation excitation – mass-dynamic polarization of the matter result in the fact that (proceeding from retention of the body impulse moment) the whole material object comprised of these atoms, e.g. the driven disc, comes to reverse in direction forced rotation coinciding with the rotary direction of the rotating mass which created a variable mass-dynamic (i.e. mass-variational) field. In this way the driven disc or screen forced rotation is excited with the rotation of the driving dynamically imbalanced disc.

The occurrence of the mass-dynamic field created by a well-balanced rotating disc without mass-variational radiation does not cause spin polarization. This explains that experimentally ascertained force interaction effects occur only with the rotation of the dynamically imbalanced disc (with a variable quadrupole moment) and they disappear with the rotation of the disc not having a dynamic imbalance.

A cyclic nature of the mass-dynamic radiation pressure on each point of the driven disc, set by the driving disc rotation frequency, causes the vibration of the driven disc plane and the precession of its axis to the direction of the driving disc rotation (in the direction of pressure alteration on it, determined by the driving disc rotation). The intensity of mass-variational radiation is relatively small, therefore, as a result of molecule (atom) "pumping" of the disc by the energy of the mass-variational radiation, the process of polarization is prolonged in time. This partly determines the observed in the experiments delay of the screen forced rotation excitation beginning relative to the disc rotation beginning.

5. The analysis of the alternative explanations of observed effects

In the process of discussing the results of the research carried out before, besides effects of electromagnetic nature to explain physical nature of the observed processes in our experiments, two more possible causes were brought forward: 1) the impact of residual air medium; 2) the vibration transferred from the electric motor and the rotating disc.

1) The weakness of the first hypothesis is that the impact of residual air medium resulting in occurrence of the disc force effect on the screen (disc, torsion pendulum) was experimentally proven [2, 3]. It is known that gas-dynamic phenomena with the residual pressure of 0.1 torr almost do not appear, while the effects determined by the gas viscosity sharply decrease with increase of the vacuum depth.

At the same time carried out experiments showed that the force mass-dynamic interaction of the discs and screens (discs, torsion pendulums), on the contrary, increases with the increase of the vacuum depth. This is determined by the decrease of the shielding effect of the residual gas medium.

When the residual pressure is 0.001 Torr (as it was in our experiments), Loschmidt number is sufficiently great (approximately $2 \cdot 10^{14}$ molecules in 1 cm^3), and gas molecules are the same material objects as the molecules of the matter comprising the screen (the second disc or the torsion pendulum). While interacting with variable mass-dynamic field created by the rotating dynamically imbalanced disc, gas molecules orientate their spins (moments of thermal motion quantity, nuclear spins) are oppositely directed to outer field. This creates a shielding effect preventing mass-dynamic field propagation and decreasing its effect on the screen. With vacuum depth increase this shielding effect decreases which was registered in our experiments [3]. Naturally, the shielding effect increases with the increase of the distance from the rotating disc to the screen (disc, torsion pendulum, etc.). This results in value decrease of the force interaction on the screen with the increase of the distance from the rotating dynamically imbalanced disc, which was also registered in our experiments.

This effect has an analogy with electromagnetic interaction – eddy currents induced in electroconductive screen by outer variable magnetic (electromagnetic) field prevent the propagation of electromagnetic field into the depth of material (skin layer, the depth of which depends on material electroconductivity and electromagnetic field frequency).

2) The weakness of the second hypothesis is that vibration effect excited by the rotation of dynamically imbalance disc on force interaction occurrence in the experiments is also obvious.

Firstly, a great mass of the thick- walled vacuum chamber and a massive experimental tool rigidly fixed in it (the total mass is more than 50 kg while the rotating disc mass is 50 gr) almost excludes vibration occurrence. Mechanical oscillation (vibration) of the experimental tool itself in our carried out experiments were not observed.

Secondly and the most important, a great dependence of the observed force interaction on the distance between the disc and the screen was experimentally registered.

A slight alteration of the distance between the disc and the screen (by a few millimeters) resulted in sharp fall, and then to a termination of their force interaction (the screen repulsion and its forced rotation). At that this appeared in experiments with different design, geometry, mass and dimensions of the experimental tool. Such a slight alteration of mechanical system parameters – a slight displacement of the small screen mass (or the second disc) can never result in such an alteration of the system vibrational properties to cause such a great (quantitative and qualitative) alteration of the observed processes nature.

Furthermore, one cannot in principle explain the following experimentally ascertained force interaction effects:

- 'blowing" and repulsion of the screen made of foil and film or repulsion of the rigid screen from the disc with a force of approximately 2.5…2.7 N, which was mentioned above;

- flexural wave excitation and each other "flowing" of the discs rotating in opposite direction or flexural wave excitation on the disc with a rigid placement of a small screen, which was mentioned above;
- forced rotation excitation of the second disc for the halt of which it is necessary to supply the second electric motor with "counter" voltage comparable with electric motor feeding voltage of the first disc or excitation of torque, rotating the screen, with the value of approximately 1 N ·cm, which was mentioned above.

6. Force mass-dynamic interaction manifistations in nature

In carried out experiments during vacuumizing as a result of gas medium density decrease, its shielding and masking effect falls. As a result, physical processes determined by the force mass-dynamic interaction and mass-variational radiation start to become clearly apparent. In examined processes force mass-dynamic interaction is observed when the distance is measured in millimeters. Herewith, a sharp rise of the force interaction value with the decrease of the distance between interacting objects (disc, screen) is experimentally ascertained.

A similar interaction, obviously, will take place during any reciprocal relative accelerated mass motions. Force mass-dynamic interaction is manifested in the most dramatic way during gas and liquid mediums motion. Owing to a small distance between interacting molecules of these mediums great mass-dynamic forces appear, which generate (if there is energy inflow) vortical processes (tornado, swirl and so forth) or e.g. short-period low tide or high tide phenomena in the Zhiguli man-made lake [4].

Gravitational waves (they represent mass-variational radiation) from space are not registered on the Earth surface as they are screened (dissipated) by the Earth atmosphere similar to that in our experiments when even a residual air medium screened mass-variational (quadrupole) radiation of the dynamically rotating imbalanced masses.

Electromagnetic interaction determined by the electric charge of particles or bodies, in particular cases are considered as: a) electric field, b) magnetic field, c) electromagnetic radiation. Similar to that mass-dynamic interaction determined by the relative location and relative motion in the space of particle masses or body masses in particular cases are considered as: a) gravitational field, b) mass-dynamic field, c) mass-variational (quadrupole) radiation – gravitational waves [5].

Mass- dynamic interaction is manifested as a matter spin polarization and material body (mass) rotation excitation with their relative motion.

The main observable type of material body motion in nature is their rotation round their own axes (planets, stars) or round the central body (planet systems and so forth). One could assume that the cause of rotation of these bodies and systems is force mass-dynamic interaction of individual particles of the matter which was manifested during their formation in the process of their relative motion under the influence of gravitational forces.

Conclusion

Experimentally ascertained mass-dynamic force affecting the screen was approximately 2.5…2.7 N, while the value of mass-dynamic torque was 1 N·cm.

The manifestation of described above sufficiently great effects of force interaction show that there is a type of interaction in nature determined by a mass similar to that which takes place during a relative motion of electric charges.

In statics it is known as gravitational attraction of masses. In dynamics during a relative motion it is mass rotation excitation, repulsion or attraction of rotating masses – depending on relative orientation of their impulse moments (motion quantity moments). During relative accelerated motion of masses this is excitation of mass-variational (quadrupole) radiation.

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