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THEORETICAL AND EXPERIMENTAL STUDY OF LINEAR IMPULSE INDUCTION TYPE ELECTROMECHANICAL CONVERTER

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Linear impulse electromechanical converters (LIEC) are designed to create mechanical shock pulses to the an object of influence with a slight movement of the actuator, or to accelerate it in a short active leg. These converters are used in many branches of science and technology as the shock-power devices [1] and electromechanical accelerators [2]. LIEP induction type provides non-contact displacement an electrically conductive armature relative to a stationary inductor excited by capacitive energy storage device using the electronic system of formation of the current pulse.

A mathematical model of coaxial LIEC, taking into account inter-related and ultrafast electromagnetic, thermal and mechanical processes that occur when you move the massive armature relative to the fixed multiturn inductor in the presence of ferromagnetic outer screen is developed.

Solving systems of equations of the mathematical model obtained by using the finite element method by integrating the spatial variables and improved method Gere in the integration over time.

It is shown that the electromechanical LIEC processes are complex, time-space character, and every time there is a significant spatial non-uniformity of the current density induced in the massive disc-shaped armature.

The technique of experimental research, which is the simultaneous recording of electrical and mechanical parameters characterizing the power and speed LIEC indicators is developed. Power parameters are recorded using a piezoelectric transducer, strain gauge system, pressure pulsation sensor and high-speed video and high-speed performance - using resistive displacement sensors.

When LIEC works as shock-power device simultaneously measures the current in the inductor and the mechanical vibrations arising from the impact of the striker on the object under study. The mechanical vibrations are measured by means of piezo noise and vibration measuring instrument VCHV-003 strain gauges or system information and measuring complex.

Information-measuring complex comprises a strain gauge signal formation, stabilized power supply, interface unit and protection, ADC and PC. Digital data from the ADC are input to a computer, where they are processed by a special software. It allows you to record the signal to determine the values of the measured parameters, the spectra and time signals oscillation damping.

On the basis of experimental studies determined: the shape, the peak value and duration of the inductor current pulse, delay time of vibration of the object exposure in relation to the time of occurrence of the inductor current, the average speed of the armature acceleration value proportional to the instantaneous electrodynamics force, and the magnitude of vibration, which is proportional to the momentum force acting the impact on the object.

To investigate LIEC, electromechanical operating as an accelerator in addition to the inductor current is measured while moving armature at each time of acceleration at the site using a resistive displacement transducer.

On the stand for the study LIEP using instantaneous velocity measurements were carried out with strain gauges armature striker video using a digital camera. After the shooting recording processing and decomposition of it into individual frames was carried out. At the same time by the time in which the anchor with the striker passes the distance to the shock plate was determined. The measured average speed in the area armature stroke in satisfactory agreement with the results of the experiments described above.

For the measurement of dynamic pressure, which has a striker plate on the drum, piezoelectric M101A06 pressure pulsations sensor firm PCB (USA) was used.

Overall, the results LIEC studies while working as a shock-power devices and electromechanical accelerator in good agreement with the calculated indicators: power indicators (the current in the inductor) - up to 4%, the power indicators (momentum electrodynamics forces) - up to 7% mechanical properties (speed of armature) - up to 9%.

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