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CONVERSION OF LC-CIRCUIT ENERGY INTO KINETIC ENERGY OF CURRENT-CARRYING METAL PLATE

A.V. KOZYREV, A.A. ZHERLITSYN

Institute of High Current Electronics SB RAS, Tomsk, Russian Federation

When conducting shock-wave experiments with metal plates accelerated to a speed of about 10 km/s, it is possible to use electric generators based on a capacitive energy storage. An analysis of the efficiency of energy transfer of a capacitive storage into the kinetic energy of a current-carrying plate (planar liner geometry) has been carried out.

The mathematical model included the equation for the current in the LC-circuit with a nonlinear load inductance and the 1-dimensional equation for the liner motion. It is shown that at a fixed dimensionless ratio, $\lambda_F = L_F/L_0$ (here, L_F is the final inductance of the liner, L_0 is the inductance of the electrical circuit), liner kinetic energy depends only on one dimensionless parameter u, which combines the parameters of the generator and the liner, and u is proportional to the initial charge of the capacitive storage. The results of a numerical calculation of the dimensionless ratio, S, of the final kinetic energy of the liner to the energy stored in the capacitive energy storage are shown in the figure 1. The dotted line shows the linear dependence of the points of maximum efficiency on the coordinate plane (u-S). The data shown make it possible to determine the optimal parameters of the capacitive storage for the given parameters of the liner, while it is necessary to ensure the lowest inductance of the electric circuit, L_0, since it determines the value of the key parameter λ_F.

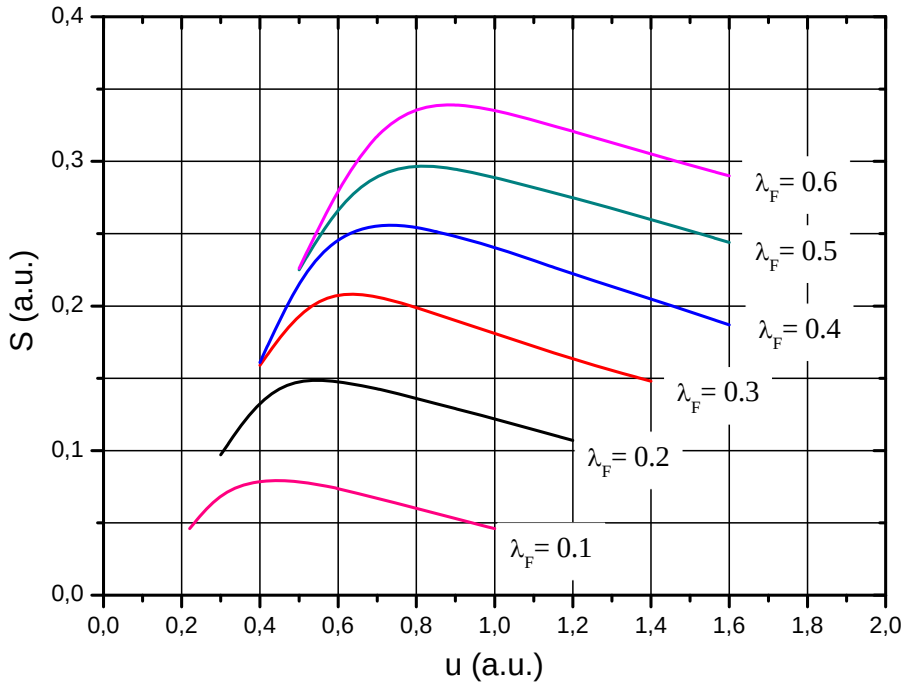

Fig.1. Dependences of the efficiency of energy transfer to the liner, S, versus the dimensionless parameter u for different dimensionless liner inductances λ_F .