

RESEARCH OF THE HORIZONTAL PENDULUM BASE HARVESTER FOR LOW ENERGY DENSITY SYSTEMS

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A proposed energy harvesting system intended to convert ambient mechanical vibration into electrical energy to power autonomous low power electronic systems [1]. The device operation is based on non-holonomic vibration system, called horizontal pendulum. This design allows developing a system without natural frequency and having possibility to excite from chaotic vibrations. Harvester uses swinging type generator with permanent magnets and built using 3-phase system followed by rectifier and energy collection system. Experimental research performed on original setup, which consists from horizontal pendulum, supported by spring and swinging rotor generator. Both elements were modelled in advance using finite element method (FEM) modelling features.

The purpose of the experimental research was to evaluate possibilities for horizontal pendulum swinging system and swinging rotor generator amount of energy from mechanical vibrations. Also the main parameters of an electrical part should be determined to be able to make a prototype for further research. We have created the first prototype of the harvester Fig. 1 and performed initial measurements.

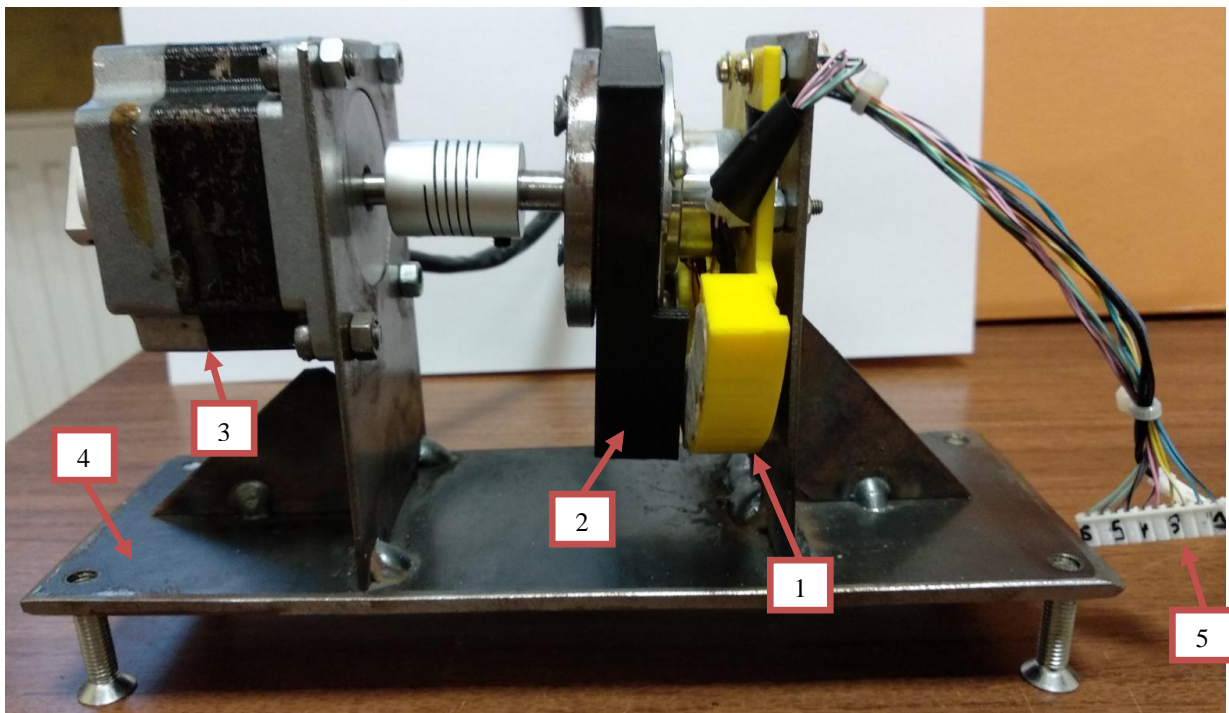


Fig. 1 Experimental setup: 1) coil holder; 2) magnet holder; 3) stepper motor; 4) device frame; 5) coil's output wires

The results of the experiments allowed us to find better design of the coil and magnetic chain. Experimental research obtained the highest voltage was generated with coil, containing 2000 windings of 0.12 mm diameter copper wire. Magnetic chain with internal core of ferromagnetic steel showed better results than internal and external core. Low frequency vibrations of 2 Hz generate enough power for desired application and using moderate mechanical resistance for horizontal pendulum harvester. The results obtained using 4 mm diameter core. The coil with the outside metal core or outside and inside core was less efficient in the sense of mechanic energy transformation into electric energy.

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