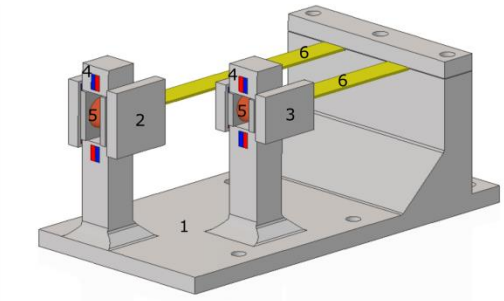
DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

The project aims at conducting the theoretical and experimental research works involving new type of linear-motion electromagnetic minigenerator for conversion of mechanical vibration energy into electrical energy. The proposed arrangement represents a family of electromagnetic generators that allow the formation of nonlinear electromechanical resonance of the system composed of a moving part of the minigenerator and the elastic element (plate spring) connected to the external oscillating system. As a result of nonlinear relationship between the magnetic stiffness of the generator and displacement, the frequency bandwidth of such a system it is much wider than in a system in which such the relationship is not present. The proposed new type of a coreless generator, as compared to known systems, is characterized by the complete symmetry of the magnetic stiffness coefficient, i.e. through suitable design changes, it is possible to obtain generators of the same geometry, but with opposite signs of the magnetic stiffness.



1 - base, 2 - moving yoke (generator with positive magnetic stiffness)
3 - moving yoke (generator with negative magnetic stiffness), 4 - auxilary poles, 5 - windings, 6 - strip springs.

Fig. 1. Concept of the dual system of electromechanical minigenerators as a mechnical vibrations energy harvesting system.

This feature enables construction of dual systems containing two minigenerators with positive and negative magnetic stiffness. Under certain conditions, whose precise determination is one of the purposes of this project, the frequency characteristics of the dual system can be considered as a pair of complementary characteristics, i. e. one of the system begins its operation once the other completes. Thanks to this frequency bandwidth, in which the system operates generating electrical energy can be several tens of Hertz wide. The cad drawing of the proposed arrangement of such the dual system is shown in Fig. 1. In order to make such operation possible, the system must fulfill a number of requirements. The main objective of the project is to conduct research in order to derive the conditions for the arrangement in Fig. 1 at which the generators operate as a pair of complementary subsystems. In particular, the planned theoretical studies have as their goal quantitative characterisation of the impact of geometry and mass on the functional characteristics of the complete system, to examine the stability and proportionality between generated electrical power and power of the mechanical vibrations, and determination of the frequency bandwidth of the considered dual system. This part of the study will be performed using appropriate computer simulation tools and computational methods such as finite element method, and the numerical algorithms for determination the frequency characteristics of and analysis of stability nonlinear systems using the Lyapunov methods. The practical segment of the project will be carried on the laboratory test stand with the purpose of validating the main hypothesis of the research.