15th INTERNATIONAL CONFERENCE
Dynamical Systems — Theory and Applications
December 2-5, 2019. Lodz, POLAND.

DSTA 2019

paper id: ENG78

Theoretical and experimental investigations of a magnetic levitation system for energy recovery

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Abstract: Energy harvesting is an emerging technology to harness energy from vibrations and converting the same to useful electrical energy. Usually, the recovered energy is quite small which, nevertheless, are sufficient to power low-demand electronic devices (wireless sensors). The paper analysis of a magnetic levitation system consists of two identical magnets rigidly mounted to the tube's end. Between them a third magnet is free to levitate due to the proper polarity. The behaviour of the harvester is significantly complicated by the strong electro-mechanical coupling among the components. The resonant frequency tuning and energy harvesting optimization can be modified by the change the distance between the magnets, modification in the coil position, use spacers, adjusting the gravity centre, additional magnet, or applying the electrical load. The Harmonic Balance Method is used to approximately describe the response of the base excited oscillator with a cubic nonlinearity, verified by path following method and experiment. Acknowledgments: The project/research was financed in the framework of the project Lublin University of Technology-Regional Excellence Initiative, funded by the Polish Ministry of Science and Higher Education (contract no. 030/RID/2018/19).

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