Energy conversion in a dynamic vibro-impact system with dielectric elastomers

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Vibration energy harvesting is important in new energy utilization. Thanks to the variable capacitance of dielectric elastomer, the dielectric elastomer generator (DEG) has great potential in vibration energy harvesting. A dynamic system with a cylinder and an inner ball is introduced in this paper to harvest the stochastic vibration energy. The both sides of the cylinder are fitted with two dielectric elastomer membranes, which are sandwiched with compliant electrodes under input voltage. The material test is conducted first to obtain the properties of the membranes. We analyze the dynamic behavior of the system under the harmonic excitation with and without stochastic noise applied. The kinetic energy of the inner ball can be transferred to the elastic potential energy of the membrane at impacts, thus resulting in the deformation of the membrane and the variation of the relevant capacitance. A higher output voltage can be generated during the relaxation of the membrane. A proper numerical model is developed to predict the energy harvester performance under deterministic and stochastic loading.