

Piezoaeroelastic system based on a double aerodynamic pendulum

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Abstract: During last decades, possibilities of using piezoelectric generators to harvest energy from the flow using various mechanical devices that perform flow-induced oscillations are intensively studied. (for instance, those that can be classified as aeroelastic systems). In this work, an electromechanical system is considered that consists of a double aerodynamic pendulum connected with a piezoelectric element. The element is connected to a load resistance. When the pendulum oscillates, the piezoelectric element is deformed, and electric voltage is generated. Aerodynamic forces acting upon the pendulum are described using the quasi-steady approach. Periodic solutions of the resulting dynamic system are studied depending on values of different parameters (such as wind speed, load resistance, etc.). It is shown, in particular, that it is possible to choose parameters of the system in such a way that the trivial equilibrium (where both links of the pendulum are oriented along the wind) is unstable when the wind speed belongs to a certain finite range of values, and asymptotically stable outside this range.

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