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Theoretical and numerical analysis of different modes in a system of a “kicked” magnetic pendulum

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Abstract: A non-linear magnetic pendulum system has been studied theoretically and numerically. The main component of the system is a pendulum equipped with a neodymium magnet, which is “kicked” by alternating magnetic field form an electrical coil underneath. The current signal which flows through the coil is repeatedly switched on and off with a given frequency and duty cycle. Switched on magnetic field introduces a two-well potential instead of a single-well gravitational potential, what results in two stable fixed points and one saddle from a dynamical point of view. Describing the system with a discrete two-state equation, different modes of regular motion have been analyzed. Existence of different solutions has been examined in terms of switching signal parameters, that is a frequency and a duty cycle. Obtained numerical results from discrete as well as continuous simulative models have been justified against experimental data from a specially constructed laboratory stand.

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