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Title: *Modeling and Dynamics of Pendulum Arms of Electromechanical Robots*

Abstract:

This thesis deals with the modeling and dynamics of systems, consisting of rigid and flexible pendulum arms, magnetically coupled with electrical circuits by means of electromechanical transducers. Two methods are used to investigate the forced pendulum for which the control parameters are the driving amplitude and frequency, and the nonlinear electrical parameter: the analytical method and the numerical method. Harmonic balance technique is chosen to tackle analytical solutions of our models. The computer based simulation tool Fortran and the classical fourth-order Runge-Kutta algorithm are employed for all numerical simulations; assuming similar initial conditions. The control law is designed following an energy-based approach. The forced response of pendulum is very rich and complex. The approximate solutions of the system of differential equations are plotted using the phase portraits. Bifurcation diagrams show various states of the model: uniperiodicity, period-doubling, quasiperiodicity, multiperiodicity, as well as chaotic behavior.

Keywords: Pendulum arm, Electromechanical systems, Robots, Rigid and °exible arms, Chaotic dynamics.