



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
PhD-17 SHORT ABSTRACT OF THESIS

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Thesis Title: Nonlinear Dynamics of Double Beam Piezoelectric Energy Harvesters under Parametric, Magnetic and Galloping Excitation

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SHORT ABSTRACT

In this research work, three double cantilever beams based nonlinear piezoelectric energy harvesting systems have been thoroughly investigated to enhance the total power output of the systems. The thesis is well written in 6 chapters. While in first two chapters introduction and literature review have been carried out, the main work has been presented in next 3 chapters and finally the thesis is concluded in 6th chapter where the future scope is also highlighted. Three problems have been solved in this work. In the first problem, nonlinear dynamic analysis of a spring coupled double beam based piezoelectric energy harvester under parametric base excitation is carried out. In the second work, the similar spring coupled double beam-based energy harvester under parametric base excitation has been studied with an introduction of magnetic repulsive force, which is induced by two NdFeB permanent magnets. In the first and second problems, comprehensive theoretical frameworks are developed by formulating coupled electro-mechanical model incorporating geometric and inertial nonlinearities, piezoelectric coupling and parametric instability. In the third work, a magnetically coupled double beam-based energy harvester under galloping excitation is investigated both theoretically and experimentally. The governing spatio-temporal second order differential equations of motion of these systems have been formulated by energy method. These equations are then reduced to their temporal forms by using generalized Galerkin's method.

The thesis is organized into six chapters. Substantial parametric studies have been conducted, and the results have been presented in three major chapters, and in addition to that, a literature review chapter where more than 230 articles have been critically reviewed and correspondingly, the major research gaps have been highlighted. All the findings from the present work are presented in the last chapter. In addition, the scope for future work, which may be extended from the present study, is pointed out.