Università degli Studi di Pavia
Dipartimento di Ingegneria Civile e Architettura

in collaboration with
Centro di Simulazione Numerica Avanzata – CeSNA
Istituto Universitario di Studi Superiori

SEMINAR

Magneto-dynamic Energy Harvester for tyre applications

The subject of the presentation is a very compact electro-mechanical wideband energy harvester optimized for tyre applications. The energy conversion process of the device takes into account the simulation of different phenomena like: non linear dynamic and adaptive resonant behaviour of the seismic mass, electromagnetic and magneto-static coupling between floating magnetic mass and coils, transfer of the generated power to an external load by means of a nonlinear circuit interface.

The presentation is focused on the pneumatic effects of the floating magnet sliding into a calibrated guide. A convenient choice of clearance between moving and fixed parts can be used to create an effective air brake preventing or softening shocks with end stops and to modify system dynamic.

A block-oriented Simulink®, experimentally validated, model has been realized to predict scavenger device performance and to optimize design parameters. Equivalent linearized stiffness and damping factors due to pneumatic effects have been modelled in the lumped parameters system to get a simplified model and to formalize relations with the geometrical characteristics. Analysis of the effect of several nonlinearities at different vehicle speed have been performed.

Prof. Elvio Bonisoli
Politecnico di Torino
Dipartimento di Ingegneria Gestionale e della Produzione

Tuesday, February 5, Aula MS1, 11.00
Dipartimento di Ingegneria Civile e Architettura
Via Ferrata,3 – Pavia

The support of the European Community through the 2010 ERC Starting Grant project "ISOBIO: Isogeometric Methods for Biomechanics" is gratefully acknowledged

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Crossing and Veering phenomena in a crank-mechanism

Modal analysis is widely used both on single components and mechanical complex assemblies and it is known to be a fundamental step on the functional design process. From experimental point of view, a change in a system parameter due to the need of describing a different assembly configuration, can require iterative measurements, and can be quite time consuming. On the other hand, by evaluating the dynamic behaviour of the single component instead of the whole system, it is not straightforward to forecast the general dynamics of the entire assembly: inertia and stiffness couplings give rise to curious dynamic phenomena, namely crossing and veering of eigenvalue loci. Many theoretical studies on eigenvalue curve crossing and curve veering, i.e. the coincidence of two eigenfrequencies or the abrupt divergence of natural frequencies trends, have been carried out in recent years, but only few references on detailed test sessions and practical applications are available. The presentation wants to give a better overview on the change of the dynamic properties of a system by comparing global mode shapes to single component mode shapes. The examined structure is a crank mechanism, made of a crankshaft joined to four connecting rods and four pistons. The chosen control parameter that is responsible of a change in the dynamic properties of the system is the crank angle. Numerical models have been used to compute eigenvalues and eigenvectors of the analysed structure, considering both FEM models and multibody approach. Finally, an original graphical interpretation of the transition between dynamic of component and dynamic of system is presented by means of the MAC index.

Dr. Marco Brino
Politecnico di Torino
Dipartimento di Ingegneria Gestionale e della Produzione

Tuesday, February 5, Aula MS1, 11.45

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