LAMPS

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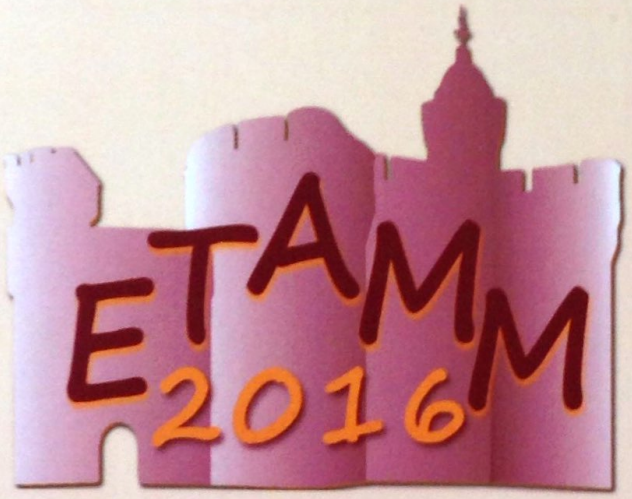
UNIVERSITÉ PERPIGNAN VIA DOMITIA



EMERGING TRENDS IN APPLIED MATHEMATICS AND MECHANICS

BOOK OF ABSTRACTS

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EMERGING TRENDS IN APPLIED MATHEMATICS AND MECHANICS

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organized by

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BOOK OF ABSTRACTS

Smart Materials in Semi-active Controlled Structures

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Abstract: We propose the efficient method of the control vibration of structures by using non-classical materials: magnetorheological elastomer and granular material subjected to controlled underpressure. The semi-active actuators enable, first, faster damping of vibrations and stabilization of a structure, second, decrease the displacements of structures subjected to an external load. In practice both vehicles and civil engineering structures can be improved in such a way. Although both granular materials and highly elastic elastomers have complex constitutive relations, we simplify these relations to prove the efficiency of actuators that operate according to a specific scenario. Our final aim is to elaborate on the material with properties appropriate for particular purpose. It should replace the active control and should work passively interacting the structure in an active way. The mathematical analysis allowed us to propose the particular control strategy. The finite element simulation, together with the solution for the control problem, proved that the damping devices should act only for a short period of each cycle of vibration. The control function depends on the type of the structure, excitation and the type of vibrations. The efficiency of the concept was proved in experimental tests. They exhibit the reduction of amplitudes at the range 10–40% in the periodically controlled case, in comparison to the constant damping.

Exact Mathematical Modelling of Dissipative Devices for Adaptive Impact Absorption

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Abstract: Adaptive Impact Absorption (AIA) focuses on real-time adaptation of energy absorbing structures to actual dynamic loading by using embedded system of sensors and semi-active dissipaters based on miscellaneous technologies including smart fluids and fast-operating valves. The crucial issue for the numerical simulation of AIA systems is accurate mathematical modelling of applied semi-active dissipaters and faithful representation of their controllable mechanical characteristics. The paper presents exact mathematical models of various types of adaptive elements including dampers with internal flow control, adaptive inerters and controllable friction-based dissipaters. Dissipative characteristics of the above devices is thoroughly investigated and range of their controllability is analyzed. In addition, various control strategies aimed at improvement of the response to impact loading are proposed and compared. Finally, application of the above controllable dissipaters in a design of more complex systems of adaptive impact absorption is discussed.