Séminaire PIMM

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Nonlinear acoustic characterization of micro-cracked materials

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Abstract

Micro-cracked materials (composites, concrete, metals, etc.) exhibit in general a strong nonlinear hysteretic elastic behavior when excited by ultrasonic waves. Due to the sensitivity of their elastic properties to the small changes that can appear in their microstructure, the dynamic stress-strain relationship considered at low strains is affected by the presence of microcracks and hence the progression of damage. Tracking the nonlinear behavior can be made by either considering a time domain or a frequency domain analysis of the elastic nonlinearity.

In this talk I will present results related to experimental observations performed on several micro-cracked materials. The break of the superposition principle, harmonics generation, resonance frequency shift, etc. have all been used to describe and monitor the evolution of the nonlinear acoustic properties when ultrasonic waves are propagating within the micro-cracked samples. Finally, the use of acoustic emission in micro-cracked samples revealed to be an

efficient tool to characterize and track the micro-damage mechanisms involved during their nonlinear behavior (ex. the slow nonlinear dynamics).

Keywords: complex materials, nonlinear acoustics, acoustic