Institute of Thermomechanics Seminar
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Lecture No. 105

Czech Society for Mechanics and Institute of Thermomechanics, CAS

invite you to a research seminar

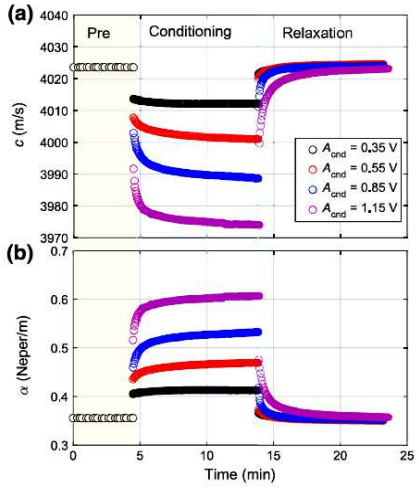
Slow dynamics effects in hysteretic elastic media: physical origin and potentiality for damage detection

given by

Prof. Marco Scalerandi

DISAT, Department of Applied Science and Technology,
Politecnico di Torino, Italy

Slow dynamics in hysteretic elastic media consists in the variation over time of the ultrasonic wave velocity when a conditioning strain is applied to the material. The phenomenon consists in three phases: pre-conditioning, during which velocity is constant (linear velocity); conditioning (i.e. application of a large strain perturbation), during which velocity evolves slowly towards a new equilibrium value; relaxation (when the conditioning strain is set to zero), during which velocity relaxes back slowly to its linear equilibrium value.



This fully reversible effect was shown in materials with a very different microstructure: metal alloys, consolidated granular media (concrete and sandstones), cracked materials and unconsolidated granular media. The presence of contact interfaces between different grains and between crack surfaces seems to be the cause of slow dynamics, but understanding its physical origin (fluids redistribution, dislocations dynamics, sliding and friction …) is still an open issue, mainly because the same physical mechanisms are not taking place in all materials exhibiting elastic hysteresis.

Here, the main experimental observations related to the relaxation process are recalled and the dependence of the effects on some parameters discussed, in view of quantifying the behavior and highlight features, which are universal for all samples, and eventually features, which are not. Finally, some results are presented to discuss how slow dynamics could be used for materials characterization and damage detection. Slow dynamics is indeed a linear measurement (relaxation) of a nonlinear effect, thus it is expected to keep the sensitivity advantages intrinsic in nonlinear ultrasonic NDT while maintaining the simplicity of the experimental set-up typical of linear ultrasonic NDT.

The lecture will be held on Wednesday, October 21, 2021 at 11:00
in the building of the Institute of Thermomechanics (new large lecture room),
Dolejškova 5, 182 00 Prague 8

Contact persons: Radek Kolman, Hanuš Seiner, Jan Kober