

# RESUME

## Retrospective view of research: underwater acoustics, nonlinear acoustics and mechanics

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The goal of this talk is to describe briefly my research profile and to discuss with colleagues how it maps into the current activity of the E<sup>3</sup> I<sup>2</sup> group, as well as about teaching opportunities.

The areas I worked in are

Photo-thermal NDT (Moscow State University: 1996-2001, MSc 1996, PhD 2000)

The problem was to numerically retrieve 1D distributions of thermal conductivity and specific heat from measurements of surface temperature. The developed continued fraction method can be applied in geoacoustical inversion.

Acoustics and mechanics of materials with microstructure (Katholieke Universiteit Leuven: 2002-2005)

These studies concerned multiscale models for materials with internal contacts (microstructure, defects) and showed how micro-geometry of solids determines their macroscopic behavior. The theory is to be applied in NDT and time reversal.

Acoustics of granular materials (Université du Maine: 2001-2002, 2006-2007)

Unconsolidated granular materials support surface waves essentially different from the Rayleigh mode. We studied theoretically, numerically and experimentally this fundamental problem and proposed an approach for diagnostics of states of granular surfaces.

Underwater acoustics: penetration into rough sediments (Institut de Recherche de l'École Navale: 2007-2008)

Theoretical study of acoustical penetration into sandy sediments is interesting for long-range detection of buried sea mines and other objects. To do that, we considered two systems accounting for physical or geometrical aspects of penetration. The physical approach was to combine the most up-to-date Buckingham model of sediment with the classical penetration problem in 1D. The geometrical issued required, on the other hand, to introduce roughness (2D simulation) of sediment but to simplify the constitutive model. As a result, we created a numerical tool estimating the penetration level in a variety of real situations. For small grazing angles and high frequencies roughness is found to make a huge positive impact on penetration, since in that system the concept of criticality is not valid. This study can be directly continued at the ENSIETA and especially its contractual activity.