

PhD Proposal 2017

Nonlinear acousto-mechanical imaging of skin aging

1. Scientific framework

Our group develops acousto-mechanical methods for processing and analysis of aging of complex medium and materials (bone, skin, tooth, bio-materials, polymers and elastomeric materials). The acousto-mechanical characterization of skin is a challenging task where innovation aspects increases for pharmacology and cosmetic applications. As known by the scientific community, the generation of nonlinear signature are directly related to the presence of ageing and memory processes induce by microdamage in material, or degeneracy in biological medium.

2. Position context

The PhD student will join U930 Inserm "Imaging and Brain" unit, in the team "Ultrasound Imaging". The team develops numerous collaborations with other groups in France and worldwide, related to ultrasound, nonlinear mechanics and signal processing for medical and Non Destructive Testing & Evaluation (NDT&E). The associated research project is presently supported by four partners, including international research centers and the [Cosmetic Valley](#), international cluster of cosmetics. The research position will be located at the Blois Campus Research Center located within INSA Centre Val de Loire Institute of Applied Sciences and conducted within the new framework signed in march 2017 (Badan Pengkajian dan Penerapan Teknologi : BPPT).

3. Job description and missions

The PhD student will be involved in the development carried out for handling a new multimodal characterization of skin aging and skin memory properties, within the framework of bio-mechanics and signal processing. More specifically, experimental Time Reversal (TR) based Nonlinear Elastic Wave Spectroscopy (NEWS) techniques will be developed around 40 MHz including bio-mechanical fatigue tests and correlation based image processing. Several nonlinear techniques have been developed and are continuously further defined including multi-modal acousto-mechanical approaches. The PhD student will have to contribute to the project. The project aims at developing experimental and theoretical techniques for nonlinear acoustic imaging of human skin under complex aging processes. A transfer from techniques frequently used for nonlinear characterization of complex materials is proposed in order to evaluate biomechanical aging properties of the human skin. The thesis aim at developing innovative experimentation of [TR-NEWS](#)[1] based techniques, completed with complex mechanical loading of skin model (provided by industrial partners) and *ex vivo* skin, in a second time. The experimental set-up will be completed by using modern ultrasonic memosducer components aim at describing memristive devices and systems[2].

Référence :

[1] Serge Dos Santos and Zdenek Prevorovsky. [Imaging of human tooth using ultrasound based chirp-coded nonlinear time reversal acoustics](#). *Ultrasonics*, **51**(6) :667–674, 2011.

[2] S Dos Santos, S Furui, [A memristor based ultrasonic transducer: the memosducer](#), *Ultrasonics Symposium (IUS), 2016 IEEE International*, 1-4(2016), <https://doi.org/10.1109/ULTSYM.2016.7728885>

[3] Online resources : [ORCID](#) : [ResearcherID](#) : [Researchgate](#) : [Scopus ID](#) : [Google Scholar](#) : [Linkedin](#) :

4. Profile

We are looking for highly self-motivated candidates with a master's degree in a discipline related to wave physics (e.g., applied physics, instrumentation, electronics, acoustics, signal and image processing). Attention will be paid to academic record, motivation for the particular position, and personal projects. Autonomy, open-mindedness and motivation, as well as good English speaking/writing skills, are also expected. The position is opened to all nationalities, but the working language should be either French or English (English communications skills are mandatory). Applications are expected immediately and until the end of june 2017 in a first phase. The ordered list of selected candidates will then be transferred to the Doctoral School who will manage the final candidate selection. If the position is not filled after this second phase, we will consider again applications until the end of september 2017.

5. Contact and additional information

A candidacy folder including a CV, a motivation letter as well as letters of recommendations, is to be sent to :

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