Institut de Mécanique et d'ingénierie de Bordeaux – UMR 5295

SHORT TERM INTERNSHIP - STAGE de MASTER 2

GENERATION AND DETECTION OF MECHANICAL WAVES FROM ORGANIC PIEZOELECTRIC SENSORS FOR NON-DESTRUCTIVE EVALUATION

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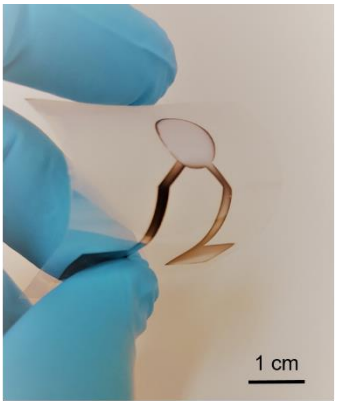
Génération et détection d'ondes mécaniques par des capteurs piézoélectriques organiques pour le contrôle non destructif



An organic printed transducer

The 3D Laser Doppler Velocimetry system from Polytec

CONTEXT:

This project intends to develop a novel generation of non-destructive evaluation (NDE) methods. In particular, the aim is to substitute conventional ultrasound evaluation which is generally implemented throughout the assembly of multiple piezoelectric ceramic sensors providing only point measurement by in situ integration of array of piezoelectric polymer sensors fabricated by direct printing method. The polymeric ultrasonic transducers could be used as both actuators and sensors to respectively generate and detect ultrasonic waves propagating through the structure containing the information about its integrity. The advantages of these flurorinated piezoelectric polymers used as ultrasonic emitter or receptor for NDE applications are numerous. They exhibit low acoustic impedance, high compliance, and broadband acoustic properties which outbalance their poorer dielectric and electro-mechanical coupling properties which are lower than conventional piezoelectric ceramics.
This novel generation of lightweight in situ integrated NDE devices represent a promising alternative to the current NDE techniques for the aeronautic industry, an actual fast growing industry due to air traffic development where safety and weight gain are the top priorities of the sector. Other fields of application could be medical imaging and additive fabrication NDT.

MISSION:

The student will perform numerical simulations and experimental investigations to characterize the transducer behavior when coupled to the solid structure to be investigated. She/He will rely on the I2M's expertise in modelling piezoelectric transducer and in analyzing guided wave generation and propagation. She/He will also rely on the IMS's expertise in conceiving and making printed transducers. The supervising teams are actually working on a PhD financing plan that would be in the continuity of the present work.

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Le/La candidat(e) réalisera des simulations numériques et des travaux expérimentaux afin de caractériser le comportement du transducteur couplé à la structure solide à inspecter. Il/Elle s'appuiera sur l'expertise de l'I2M dans la modélisation de transducteurs piezoélectriques et dans l'analyse de la génération et la propagation d'ondes guidées. Il/Elle s'appuiera également sur l'expertise de l'IMS dans la fabrication de capteurs imprimés. Les équipes travaillent actuellement à un plan de financement pour une thèse dans la continuité de ce sujet.

The objectives can be summarized as follows:

- Modelling the mechanical and piezoelectric behavior of the transducer built by IMS coupled to a solid structure using finite elements (**Comsol Multiphysics**)
- Experimentally characterizing the transducers using **3D Doppler Velocimetry**.
- Optimizing a single and an array of flexible piezoelectric ultrasound sensors to achieve nondestructive evaluation

Candidate profile: For this study, knowledge of physical acoustics is necessary. Some knowledge of signal processing or material science would also be appreciated.

Pratical information:
The project will take place at the I2M institute in Talence and will be in collaboration with the IMS institute for the transducer making.
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Superviors :
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Starting date: in February or March 2021
Duration: 5 to 6 months
Salary: 560 €/month

Application: Applications have to be sent by mail to samuel.rodriguez@u-bordeaux.fr **before the 15th of November**.
The application must include a complete resume, a cover letter, transcripts of Master 2 and recommendation letters if available.