

**Progetto:****Sviluppo di trasduttori piezoelettrici per ispezioni con onde guidate****Research project:****Development of piezoelectric transducers for guided waves inspections**

The activity that will be carried out at the University of Bologna concerns the development of novel piezoelectric transducers for ultrasonic guided waves (GWs) inspections.

The permanent integration of GWs technology is limited by several factors: bulky hardware instrumentation and large number of connecting cables, high power consumption and, consequently, high integration costs. Such limitations hampers the adoption of the GW technology in application domains with stringent weight requirements (e.g. aerospace and automotive).

The aforementioned limitations will be addressed with both 1) novel transducers and 2) dedicated electronic systems. The transducers will consist of a set of devices with inherent beam steering capabilities, able to generate and detect directional ultrasonic guided waves within a structure with minimal hardware requirements. The peculiarity of the proposed devices is the capability to generate ultrasonic waves along arbitrary directions on the structure depending on the frequency content of a single excitation signal (frequency steerable transducers- FSAT), or to automatically detect the direction of arrival of mechanical waves generated by impacts and propagating within the structure.

The principal result of the research activity will consist in the assessment of the performances of the FSAT technology for the structure inspection task. Thanks to its unique features, FSAT will rely on an extremely simplified circuitry. The novel transducers and their dedicated signal conditioning electronics will be a cornerstone for the realization of distributed sensor networks for monitoring applications.

**Training programme**

The research training programme combines uniquely, inter-sectoral and multidisciplinary research activities (simulation, signal processing, sensor integration) in the field of ultrasonic technologies. Only the proposed multidisciplinary approach of combining simulation and signal processing tools, transducer integration, reliability studies, and standardisation activities with the goal of fully exploiting the huge potential of this cutting-edge technology. The training curriculum will focus on methodological training in ultrasound physics and materials science basics, simulation, signal processing of guided waves and ultrasound.

The specific training objectives are:

- to convey substantial fundamental knowledge of all aspects of guided wave systems implementation, including simulation, data analysis and reliability,
- to develop researcher's transferable skills: to work effectively and efficiently, to communicate with different audiences, to identify and exploit entrepreneurial opportunities and to prepare him/her for academic or industrial careers.