



Job offer: doctoral position in CEA/SACLAY, France (expected start date: sept. 2023)

Context: The MSCA doctoral network USES2 (www.uses2.eu) involves ten beneficiary partners working together to improve knowledge and use of ultrasonic and seismic embedded sensors for the non-destructive evaluation and structural health monitoring (SHM) of critical infrastructures and objects. The objectives of USES2 is to promote R&D and training of researchers. Within USES2, eleven doctoral positions are proposed.

CEA, in cooperation with IFFSTAR, ENSAM/CNRS and secondments (BAM, ENI, Faber), is leading research dedicated to the development and test of a **High speed/High capacity distributed FBG sensing technique for SHM applications**.

The doctoral position is opened for a European Master student, motivated in conducting its PhD in a Doctoral Network, and willing to move in several partnership countries (France, Germany, Italy). Competencies in instrumentation, optics, fiber optics, laser, electronics and signal analysis are sought. A minimal B2 English level (upper intermediate) is required.

Technical background: Schedule-driven Non-Destructive Evaluations (NDE) are carried out during structure/equipment' life to detect major degradations endangering safety and impairing service availability. In addition to NDE, Structural Health Monitoring (SHM) involves the use of in-situ sensing systems and algorithms to evaluate structure worthiness. Condition-based maintenance (CBM) is therefore progressively emerging with the aim to anticipate failure modes and reduce indirect cost and production/service downtime. NDE/SHM make an increasing use of Optical Fiber Sensors (OFS) because of their intrinsic advantages (distributed and quasi-distributed measurements along a single fibre strand, small size, electromagnetic-immunity, etc.). Among OFS, Fibre Bragg Gratings (FBGs) are photowritten on singlemode telecommunication fibres, providing both wavelength-Division Multiplexing (WDM) and high spatial localization (mm). FBGs are tiny sensors (150 μm in diameter, possibly less), already successfully implemented within concrete, metallic and composite materials, along with connection procedures for interrogation during operational or maintenance phases. FBG sensors provide in situ strain (and temperature) measurement and give valuable data about internal strain change due to fatigue and defects propagation inside the material. FBGs are also used for acoustic sensing in association with piezoelectric actuators or laser ultrasonics (US) in order to perform tomography reconstruction and identify defects (delamination etc.) inside complex high-value structures.

Commercially available FBG readout units rely upon WDM or Optically Frequency-Domain Reflectometry (OFDR). WDM-based units are limited in capacity (several sensors) but may reach high scan rate (MHz). Conversely, OFDR-based units are limited in scan rate (several tens of Hz) but may accommodate large number of sensors (typically up to 2000). Tomography with acoustic techniques requires both high capacity and high scan rate with the aim to improve quality of image reconstruction. Optical Time-Stretch (OTS) is a time-domain technique that has potential to improve both capacity and scan rate and to open the way to efficient tomography reconstruction processes.

Expected results: Several OTS setups will be investigated according to end-user needs and qualified in laboratory conditions. Experimental tests on several sites are planned: at BAM's (Berlin, Germany) on a concrete structure, at Faber's (Cividale del Friuli, Italy) on a composite canister, and at ENI's (Milano, Italy) on a metallic pipeline.

Host laboratory: Created in 1945, the CEA (Atomic Energy Commission) is a French government R&D organization committed to 4 main missions: national defence, development of low-carbon energies (renewable/nuclear), fundamental research (biology, physics) and technological transfer to industry. The CEA is established in 9 centres over the French territory (5 military centres and 4 civil centres). With more than 16000 permanent people, CEA hosts approximately 1500 Ph.D students. The Saclay R&D Centre (1952) is situated 25 km away from Paris. Initially dedicated to nuclear studies, it is now a multi-disciplinary center involving more than 5000 permanent researchers. It now belongs to Paris-Saclay University, the biggest university in France and among the world top 20 (ARWU 2022) and is easily accessible by public transportation and company buses (a metro line is expected for 2025). In the city-like center, you will find a scientific library, 3 restaurants, a bank, a cultural centre (library, etc.). The host laboratory (LSPM) is specialized in optical fiber sensing (FBG, distributed monitoring) for harsh environments and SHM applications.

How to apply ?: For your application to be taken into account, it has to be posted onto the **Euraxess website**.

<https://euraxess.ec.europa.eu/jobs/81084>

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