Full title: **A scalable strategy to localize impact events on structures using low-frequency vibrations: from the experimental validation on a metallic plate to a proof-of-concept on a composite aircraft fuselage**

Short title: **A scalable strategy to localize impact events on structures**

Reporting impact events from passive vibration measurements is an important topic of Structural Health Monitoring (SHM). The objective is to localize an impact and assess its severity directly from the impact-induced vibrations collected by a few sensors installed on the structure. Of major importance is the detection of ground support equipment impacts (cargo loaders, catering vehicles, etc.) on a composite aircraft during servicing on ground at the airport. It is indeed well known that an impact on a composite structure may produce internal damages that can show little or no exterior visibility. An automated real time SHM system could then aid in reporting significant impact events to optimize current maintenance procedures for composite fuselages and not delay departure of the aircraft for structure checks.

In this talk, we present a scalable passive vibration monitoring strategy for localizing impact events using low-frequency vibration measurements. The proposed methodology exhibits three key features. First and foremost, the proposed technique is pointwise: the underlying theory shows that an impact can be identified from vibration measurements collected at a single sensor location. On the contrary, conventional wave-based approaches require at least three sensors to localize an impact on a plate-like structure. Second, the method is robust with respect to measurement noise and model uncertainties, tempering the difficulty of using only the impact-induced set of vibration measurements. We present a numerical procedure to compute mappings of the structure evidencing a priori which impact locations can be robustly identified. Third, experimental validations show that the proposed strategy is scalable: it has been validated on structures of increasing complexity and dimensions, from a metallic plate in laboratory conditions to an A350 aircraft on ground in outdoor conditions.