

# **MAPOD for guided wave Structural Health Monitoring and applications**

**Olivier Mesnil<sup>1</sup>, Sanjay Sharma<sup>2</sup>, Bastien Chapuis<sup>2</sup>, Pierre Calmon<sup>2</sup>, Oscar D'Almeida<sup>3</sup>**

<sup>1</sup>NDE department, CEA-List, France, <sup>1</sup>NDE Department, CEA-List, France, <sup>1</sup>Sensor and applications, Safran Tech, France

In Guided Wave Structural Health Monitoring (GW-SHM), performance demonstration is a key aspect required to lift the technologies from the laboratory to the industry. By analogy with Non-Destructive Evaluation (NDE), the computation of Probability of Detection (POD) curves could be a satisfying metric to do so. However, SHM specificities lead to the need to rethink the POD estimation for SHM. Among these specificities is the fact that the experimental generation of large datasets is prohibitively expensive due to the permanent integration of the sensors in SHM and the large area inspection of GW. Moreover, SHM solutions proposed using successive measurements acquired by a permanently installed sensor network on a growing defect face the difficulty of statistical dependency of data, violating the common NDE-POD assumptions. The role of MAPOD (Model Assisted POD) in a future methodology nowadays meets a wide agreement to quantify the efficiency of an SHM system at a reasonable cost. In this communication, we illustrate the potential of MAPOD in such a methodology on two use-cases representing two inspection paradigms in SHM. The first one is the POD estimation for the successive inspections of a growing crack in an aluminum panel. The second is the sudden appearance of a delamination in a composite panel. In both cases, a special care is given to reproduce real life configurations with representative variabilities of interest. Data are numerically created with CIVA to reproduce both statistically dependent and independent data to illustrate the application of various POD tools.