THU.2.B.1

Author: Olivier Mesnil - CEA-List

Co-Authors: Olivier Mesnil (CEA-List) | Pierre Calmon (CEA-List) | Bastien Chapuis (CEA-List) | Roberto Miorelli (CEA-List) | Xavier Artusi (CEA-List) | Christophe Reboud (CEA-List) | Oscar d'Almeida (Safran Tech)

TITLE: MODEL ASSISTED PROBABILITY OF DETECTION IN STRUCTURAL HEALTH MONITORING APPLIED TO IMPACTED COMPOSITE STRUCTURES

ABSTRACTS

In Guided Wave Structural Health Monitoring (GW-SHM), reliability and performance demonstration is one of the main challenges to overcome to ensure industry adoption. However, the cost of computing a Probability of Detection (POD) from experimental data is much higher in SHM than in NDE due to the permanent integration of sensors. In addition, SHM presents specificities (such as the dependency on environmental and operational conditions, the durability of sensors over time, the need for complex algorithms in post-processing) which makes especially relevant the use of simulation in the reliability assessment process. A methodology of performance demonstration based on numerical tools and dedicated to GW-SHM is therefore required.

This work proposes the application of the Model Assisted POD (MAPOD) approach on the case of a guided wave imaging technique, which consists of creating an image representing the health of the inspected structure using a sparse grid of ultrasonic transducers. The use of simulation allows studying the response of the system for a large set of possible configurations, accounting for the variability of defect morphology, of transducer performances or environmental conditions. In order to compute the POD for the range of input parameters of interest, a meta-model of the configuration is built from the forward model of the CIVA software.

The illustrative use-case is an aerospace composite panel instrumented by piezoelectric transducers and the studied defect is an impact-like delamination of various size, position and morphology. A dedicated detection criterion is developed for the application and the false alarm rate is studied with Receiving Operating Curves.

KEYWORDS

MAPOD | SHM | Guided wave imaging |