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ABSTRACT

PRESENTATION

PAPER

Mathias Kersemans obtained a PhD in engineering pysics from Ghent University on the topic of ultrasonic characterization of composite materials in 2014. He is currently an associate professor in the Mechanics of Materials and Structures research group (UGent-MMS) at Ghent University, where he is leading the research on non-destructive testing and structural health monitoring of advanced light-weight materials. His research team focuses on the development of novel and sensitive (nonlinear) inspection techniques for accurate monitoring and assessing the damage state in complex materials. This includes design of experimental methodology, optimization of excitation and acquisition strategy, advanced signal and image processing, prognostic damage evolution and estimation of remaining useful lifetime. He is author of more than 80 publications in SCI Web of Science.

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PHASE INVERSION THERMOGRAPHY FOR SENSITIVE AND DEPTH-RESOLVED INSPECTION

Exciting a test object by a frequency/phase modulated heating waveform, and analysing the dynamic AC component of the thermal response, leads to high-contrast and depth-resolved thermographic imaging results. However, the stable extraction of the AC component is often problematic in real inspection cases, resulting into sub-optimal imaging quality.

This study introduces the concept of phase inversion thermography in which the test object is heated by two consecutive heating waveforms having an inverted phase. Subsequent subtraction (or addition) of the acquired thermal responses provides a direct way to isolate the AC (or DC) component, leading to high-quality and depth-resolved inspection results (see figure below). In addition, the proposed phase inversion thermography method allows to identify possible sources of nonlinearities in the thermal imaging, e.g. due to nonlinear radiative heat dissipation or nonlinear response of the heating device. The imaging performance of the method is numerically and experimentally demonstrated for the optical thermographic inspection of composite aircraft A320 components. The excellent noise resistance of the proposed phase inversion thermography method is further demonstrated for low-power vibro-thermographic inspection of composites.