

Characterization of Vertical Cracks Using Burst Vibrothermography

Arantza Mendioroz^{C, S}

Department of Applied Physics I, University of the Basque Country UPV/EHU, Bilbao, Spain
arantza.mendioroz@ehu.es

Ricardo Celorrio

Department of Applied Mathematics, EINA/IUMA, University of Zaragoza, Zaragoza, Spain

Agustín Salazar

Department of Applied Physics I, University of the Basque Country UPV/EHU, Bilbao, Spain

The detection and characterization of kissing vertical cracks is a challenging task. Standard non-destructive evaluation techniques currently applied to detect surface breaking and shallow subsurface cracks, like liquids penetrants and Eddy currents, are not able to size the in-depth extent of the crack accurately. Ultrasound excited thermography (vibrothermography) has demonstrated its capability to detect defects such as cracks or delaminations in a wide variety of materials both in modulated and burst regimes. In vibrothermography the sample is excited with ultrasounds and at the defects heat is produced because of friction between the defect faces. The surface temperature rise above the defect can be measured by an infrared camera. In a previous work, we developed a stabilized inversion algorithm to characterize vertical cracks from lock-in vibrothermography data obtained at several modulation frequencies. The drawback of this approach is that data taking is rather time consuming. In this work, we present a method to characterize vertical cracks from burst vibrothermography data, in which data taking is much faster. We compute the evolution of the surface temperature distribution when a sample containing a vertical crack is excited by means an ultrasound burst. By inverting synthetic data with added white noise we have analyzed the accuracy of the method to characterize the size and position of the crack depending on the burst duration and the noise in the data. Finally, we have prepared samples containing calibrated inner heat sources of different shapes. The inversions of experimental data obtained from the calibrated samples confirm the capability of the method to characterize vertical cracks.