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Damage Depth Estimation on a Fatigue Loaded Composite Structure using Thermography and Acoustic Emission

Joseph N. Zalameda, William P. Winfree, and Michael R. Horne¹, NASA Langley Research Center, MS231 Hampton, VA 23681; ¹National Institute of Aerospace, NASA LaRC, Hampton, VA 23681-0001

Passive thermography and acoustic emission data were obtained on a three stringer panel during periodic fatigue loading. The acoustic emission data were mapped onto thermal data, revealing the cluster of acoustic emission event locations around the thermal signatures of interest. By combining both techniques, progression of damage growth is confirmed and areas of failure are identified. Furthermore, sudden changes in thermally measured damage growth related to a previously measured higher energy acoustic emission event are studied to determine damage depth. A multi-layered thermal model with a periodic flux heat source is presented using the quadrupole method to determine the relationship between the damage depth and thermal response. The model results are compared to the measured data. Lastly, the practical application and limitations of this technique are discussed.