Title: Non Destructive Testing Methods Combined with Computational Analysis to Determine Properties and Health of Materials

Analysis of the mechanics of an acoustic thermographic non-destructive evaluation (NDE) and its extension to an advanced acoustic wave generation is the topic of this paper. NDE is among the most effective and powerful materials evaluation and prognosis tool available for high performance turbomachines which increasingly incorporate advanced materials and extreme operating conditions. In the current work we investigate the mechanism of heat generation in acoustic thermography in detail using a combination of computation and experiments. We use the validated model to carry out a model based evaluation of an advanced thermographic based acoustic NDE method which if successful this technique could revolutionize the ease of data gathering and data monitoring. We address many of the challenges typical of this type of system, principal among them are crack detection threshold, signature quality and the effect of defect interactions. We use experiments and finite element (FE) based numerical simulation to evaluate the proposed method and draw conclusions on the viability for future extension and integration with other digital technologies for health monitoring. Our FE model is capable of capturing various distinct sources of emission signatures from defects and we validate it with a traditional acoustic method. We also use this method to determine the magnitude of the different sources of heat generation during an acoustic excitation. Defects formed through industrial operation as well as defects formed through artificial manufacturing methods were analyzed and compared.

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The public is welcome to attend.