Qualitative analysis of a vibrothermography model

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Vibrothermography is an proficient technique, capable of localizing defects in a material in a non-destructive way. By exciting a damaged component with elastic waves, closed defects will experience friction, resulting in the dissipation of energy through thermal diffusion. This can already be achieved using low power excitation, especially when exciting at frequencies corresponding to the in-plane local defect resonances. Apart from localizing these incipient defects, it is equally critical to characterize them, anticipating the growth of the defect for future monitoring. In order to fulfill this objective, support of a theoretical framework is of utmost importance. A multi-physics model applicable to vibrothermography has been developed based on an established numerical model, capable of describing the propagation of an elastic wave through some material and the nonlinear wave generation due to frictional effects on the contact area of a crack with rough surfaces. This model has been extended with the description of the instantaneous energy dissipation induced by the frictional effects. In this work, we will present the details of the model capable of addressing the effects of nonlinear wave generation and heat generation due to friction at the defect's rough surfaces. We will perform a case study and discuss the obtained results qualitatively.