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Evaluation of Thermal-damages in Tube-like Structures using Ultrasonic Guided Waves

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Summary

This paper aims at an experimental method for detecting thermal-damages in a tube-like structure using acoustic nonlinear parameter of ultrasonic guided waves. The material nonlinearity of aluminum pipe specimens, which have been subjected to different heat-loading cycles, is measured to characterize the micro-damages. Flexible Polyvinylidene Fluoride (PVDF) comb transducers are used to generate and receive the fundamental and second harmonic waves. The amplitude of the second harmonic wave is extracted from the Fast Fourier Transform (FFT) spectrum of a received signal. The measured relative nonlinear parameter increases monotonically as a function of the propagation distance, and the relative nonlinear parameter becomes greater when the specimen is exposed to higher heat-loading cycles. These results indicate that the proposed experimental setup is applicable to assessment the micro-damages in a pipe, and the relative nonlinear parameter is a potential candidate for the prediction of micro-damages in a tube-like structure.