

Development of a Self-Sensing and Self-Healing Bolted Joint

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Abstract

A self-sensing and self-healing bolted joint has been developed. This concept encompasses the areas of health monitoring, joint dynamics and smart materials. In order to detect looseness in a joint the impedance health monitoring method is used. A new method of making impedance measurements for health monitoring that greatly reduces the equipment cost and equipment size was developed. This facilitates implementation of the impedance technique in real-life field applications. Several proof of concept experiments are presented and compared to the traditional method of making impedance measurements.

Investigations of bolted joint dynamics were conducted. A literature review of bolted joints and their diagnostics is presented. The application of the transfer impedance method is compared to standard modal tests on various bolt tensions. An investigation of damping in bolted joints was also made comparing a bolted and monolithic beam.

Practical issues in adaptive bolted joints are investigated. This includes issues on activating/heating SMA actuators, connecting the actuators to the power source, size selection of SMA actuators and insulations. These issues are examined both experimentally and theoretically.