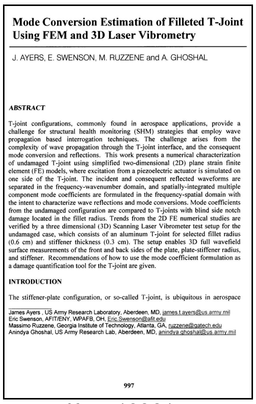

Mode Conversion Estimation of Filleted T-Joint Using FEM and 3D Laser Vibrometry

J. AYERS, E. SWENSON, M. RUZZENE and A. GHOSHAL

ABSTRACT

T-joint configurations, commonly found in aerospace applications, provide a challenge for structural health monitoring (SHM) strategies that employ wave propagation based interrogation techniques. The challenge arises from the complexity of wave propagation through the T-joint interface, and the consequent mode conversion and reflections. This work presents a numerical characterization of undamaged T-joint using simplified two-dimensional (2D) plane strain finite element (FE) models, where excitation from a piezoelectric actuator is simulated on one side of the T-joint. The incident and consequent reflected waveforms are separated in the frequency-wavenumber domain, and spatially-integrated multiple component mode coefficients are formulated in the frequency-spatial domain with the intent to characterize wave reflections and mode conversions. Mode coefficients from the undamaged configuration are compared to T-joints with blind side notch damage located in the fillet radius. Trends from the 2D FE numerical studies are verified by a three dimensional (3D) Scanning Laser Vibrometer test setup for the undamaged case, which consists of an aluminum T-joint for selected fillet radius (0.6 cm) and stiffener thickness (0.3 cm). The setup enables 3D full wavefield surface measurements of the front and back sides of the plate, plate-stiffener radius, and stiffener. Recommendations of how to use the mode coefficient formulation as a damage quantification tool for the T-joint are given.

INTRODUCTION

The stiffener-plate configuration, or so-called T-joint, is ubiquitous in aerospace

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997

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Ключевые слова:

Содержание.

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