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Guided Waves-Based Damage Detection in Aircraft Component

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In this paper the investigation of a structural health monitoring method for thin-walled aircraft part is presented. The concept is based on the guided elastic wave propagation phenomena. This type of waves can be used in order to obtain information about structure condition and possibly damaged areas. In reported investigation piezoelectric transducer was used to excite guided waves in chosen structural element. Specimen was a riveted panel from an aircraft structure. Dispersive nature of guided waves results in changes of velocity with the wave frequency, therefore a narrowband signal was used to minimize the dispersion phenomenon. The generated signal was amplified before applying it to the transducer in order to ensure measurable amplitude of excited guided wave. Measurement of the wave field was realized using laser scanning vibrometer that registered the velocity responses at a points belonging to a defined mesh. This non-contact tool allowed to investigate phenomena related to wave propagation in considered aircraft element. Due to high complexity of the element baseline measurements were taken before measurements for component with the introduced discontinuity. Signal processing procedures were developed in order to visualize the interaction of elastic waves with specimens components (rivets, etc.). In the second stage of research the signals gather by laser vibrometry method were input to the damage detection algorithms. Signal processing methods for features extraction from signals were proposed. These features were applied in order to detect and localize the presence of damage. In the first step damage detection was based on full wavefield measurements. In this way it was possible to obtain amplitude contrast between region with discontinuities and without them. In the second step a point-wise damage detection was conducted. It was based on several laser measurement points treated as sensors. The signal processing was conducted in MATLAB with the procedures developed by authors. The results of damage detection were compared with each other and conclusions were drawn.

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Ключевые слова:

Содержание.