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LAMB WAVE BASED MONITORING OF PLATE-STIFFENER DEBODING USING A CIRCULAR ARRAY OF PIEZOELECTRIC SENSORS

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Abstract- In this paper we propose an efficient way of localization and parametric identification of metallic plate-stiffener debonding. A concept and experimental results based on a circular array of Piezoelectric Wafer Active Sensors (PWASs) is presented. Implementation of this circular array of PWASs combines the Lamb wave technique and symmetry breaking in the signal pattern to monitor the growth of a debonding of a stiffener on a metallic plate. Wavelet time-frequency maps of the sensor signals are employed and a damage index is plotted against the damage parameters for frequency sweep of the excitation signal (a windowed sine signal). Wavelet coefficient in time gives an insight regarding the effect of debonding growth on the Lamb wave transmission in time-frequency scale. We present here a method to eliminate the time scale effect which helps in identifying easily the signature of damage in the measured signals including the reflection from the boundary of the plate. The proposed method becomes useful in determining the approximate location of the damage with respect to the location of three neighboring sensors in the circular array. A cumulative damage index is computed for varying damage sizes and the results appear promising.

Index terms: Circular array, piezoelectric, wavelet, damage index, lamb wave, plate, debonding.