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**TITLE:** FULL WAVE FIELD SIGNAL PROCESSING TECHNIQUES FOR NDT OF CFRP AIRCRAFT PANEL: A CASE STUDY

**ABSTRACTS**

Composite materials (e.g. carbon fiber reinforced polymer CFRP) are increasingly used for critical components in several industrial sectors (e.g. aerospace, automotive,…). A major challenge is the detection of internal damages in these composites which may have occurred during manufacturing or during operational life.

One possibility for damage detection in thin-walled composite structures is to analyze the elastic wave characteristics measured on the surface. Many different wave actuation and sensing configurations are possible combined with advanced data processing methods. In this study, a single piezoelectric actuator is used for excitation combined with a 3D scanning laser Doppler vibrometer to measure the resulting full wave field.

Depending on the frequency of excitation, different approaches are used. At relatively low frequencies, i.e. 5 to 100 kHz, damages can be localized by searching for local defect resonances (LDR). In this case, the full field steady-state vibration is analyzed in the frequency domain. At higher frequencies, i.e. 100 to 300 kHz, wave propagation analysis is conducted in time domain to search for defect-wave interactions e.g. wave amplification, wave scattering, change in local wave number, …

In this study, the applicability of full wave field signal processing techniques for the detection of production defects in a CFRP aircraft panel with stringers (A320 tail spar) is investigated. Multiple data processing strategies (e.g. automated LDR detection and acoustic wave number spectroscopy) are used and the damage identification and localization performance is critically compared and evaluated.

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**KEYWORDS**

Composites | Non-destructive testing (NDT) | 3D scanning laser Doppler vibrometer | Guided waves | Local Defect Resonance (LDR) |