Lockin Shearography and Lockin Thermography for NDT of Large Aircraft Components

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Abstract

In aircraft industry, every component must undergo non-destructive testing before it is cleared for usage. Since traditional scanning NDT techniques are too time consuming, innovative methods are required to achieve testing times that are suitable for online-monitoring and fast maintenance inspection. This requirement is fulfilled by shearography and thermography, which both are industrialised large area inspecting NDT methods. Due to the (IR-) camera monitoring of the whole surface, even large components can be tested within minutes. Additionally, due to their mobile and contact-free setups, both techniques are compliant to difficult geometries like curved surfaces. By use of the lockin principle their signal-to-noise ratio and depth resolution are significantly improved. There are several methods for modulated excitation of thermal waves, of which optical and pressure based excitation are used for shearography and optical and ultrasonic excitation for thermography.

After demonstrating the potential of both methods on CFRP plates with simulated defects (delaminations and impact damage) we present results that we obtained on large aircraft components:

- Complete horizontal stabilizer of FS35 built by Akaflieg Stuttgart,
- Wing of the electrically powered e-Genius (Institute of Aircraft design, University of Stuttgart),
- Landing flap section of Airbus A 320,
- Complete rudder of Airbus A 320,
- Test panel of Dornier 328 (with stringer disbond)

The results indicate the differences between lockin shearography and lockin thermography in terms of their specific response which is in both cases based on thermal waves.