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Wavelet transform applied to pulse thermographic data for detection of subsurface defects in aluminum structures

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Abstract:

In this study, we focused on pulse infrared thermography as a non-destructive testing method for detection of subsurface defects in aluminum structures. In the present investigation, a square shaped (180 m * 180 mm) aluminum specimen with 10 mm thickness and artificial defects with circular cutouts of varying depth and diameter at the back side was manufactured. The sample was excited at several modulation frequencies by a sinusoidal heat flux, and a thermal infrared camera was utilized for monitoring of surface temperature of a thermal wave that propagated into the sample. Wavelet transform was applied to compute phase angle data from the temperature-time history of each pixel for the assessment of the defects. A phase image was calculated using a Fourier transform and the Wavelet transform. Image processing software MATLAB and Thermofit Pro were used to compute the phase image. The investigation into the effects of wavelet parameters; scale and shift, modulation frequencies, inclusion sizes, and depths on the phase contrast was conducted and discussed.

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