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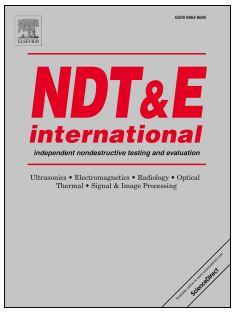

Comparative study of thermal contrast and contrast in thermal signal derivatives in pulse thermography

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Comparative study of thermal contrast and contrast in thermal signal derivatives in pulse thermography

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Abstract

For detection of subsurface defects, flash thermography results are often evaluated by selecting the thermal image with the largest contrast between the sound and defective area. Another possibility is to calculate the logarithmic derivatives of the thermal signal, and evaluate the 1st or 2nd derivative images. In this paper, it is investigated how the contrast in these images depend on the defect size and defect depth. Analytical calculations and FEM simulations are presented, and based on these results equations for the contrast maxima are derived. Several advantages of the derivative images are shown; for example a defect with an aspect ratio around unity can be reliably detected in the derivative image, but not in the thermal image. To demonstrate these results experimental data are also presented.

Keywords: thermal contrast; pulse thermography; logarithmic derivative; defect detection; TSR

1. Introduction

Flash thermography is a technique that is used more and more for non-destructive testing, for evaluation of thermal properties [1-3] or for localizing subsurface defects [2,4]. The very short flash pulse is absorbed by the sample surface and the heat diffuses from the surface into the material. Interfaces between material layers with different thermal properties or subsurface defects disturb the heat flow; hence, by analyzing the temperature surface that is recorded with an infrared camera, much information can be obtained about the inner structure