The 2nd International Conference on welding, nondestructive testing and the industry of materials and alloys (ICWNDT-MI'10)

2010

INVERSE PROBLEM FOR MICRO STRUCTURAL DIMENSION SCALES FORECASTING IN ULTRASONIC MATERIAL CHARACTERISATION

Fairouz BETTAYEB

Abstract : The inverse problem in materials analysis puts some challenges because the composition variables are both discrete and continuous and because the engineering properties are highly nonlinear functions. Ultrasonic non destructive testing data are difficult to interpret since they require analysis of continuous signals for eachpoint of the materialunder consideration. However detected echoes are corrupted by electrical, pulse, ringing and structure noises. Various de-noising methods as: split spectrum processing, adaptive time-frequency decomposition, Wigner-Ville distribution, wavelet, Hilbert-Huang transforms and others are useful, if this noise is described as a zero-mean Gaussian white noise. But if the noise origin is caused by the material small reflectors, grain boundaries and other microstructures scattering, classical methods are not very helpful for this issue. In this paper we address the non linear featuresof back scatted ultrasonic waves from steel plates, for understanding the material micro structural behaviour. The following structural noise data experiments captured from a steel piece, may give significant insights into the relationship between backscattered noise and material microstructures which can ensue to understand the micro structural dimension scales. These experiments denote the well established filtering method developed in this work, and will give a framework to the investigation of material microstructure features. The experiments show a challenging interface between material properties, calculations and ultrasonic wave propagation modelling

Keywords : soudage, cnd, l'Industrie des Métaux