

# **Time - frequency and time - scale representations for the ultrasonic Non Destructive Testing and Evaluation of materials with high structural noise.**

**H. Dhifaoui, M. Khelil, J.H. Thomas, R. El Guerjouma, L. Simon**

**Abstract :** Time - frequency and time-scale methods are proposed to perform the analysis of Non Destructive Testing and Evaluation (NDTE) ultrasonic signals received during the inspection of stainless steels and the stainless steel welding. The non-homogeneous nature of such materials induces a very high level of structural noise which greatly complicates the interpretation of the NDTE signals. In such conditions, classical temporal or spectral signal processing is not effective. By combining the time domain and frequency analysis, the wavelet transform provides simultaneously spectral representation and temporal order of the signal decomposition components and can give relevant information to separate the structural noise from other echoes present in the signal in particular those of defects. A time-scale approach providing by the continuous wavelet transform is used and some representations given by the cross wavelet transform are considered. The time-scale analyses show that we could separate in the time-frequency and time-scale representations, the structural noise from other echoes present in the signal. This work opens new fields in the ultrasonic NDTE of materials with high structural noise as austenitic steel and austenitic steel welding.

**Keywords :** Non Destructive Testing and Evaluation, Stainless Steels Austenitic, Structural noise, Ultrasonic, Wavelet transform, welding