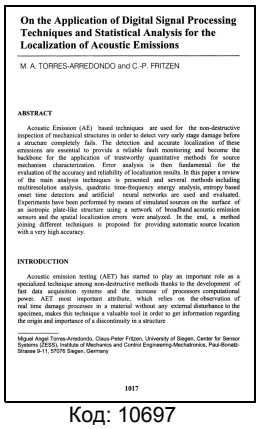
On the Application of Digital Signal Processing Techniques and Statistical Analysis for the Localization of Acoustic Emissions

M. A. TORRES-ARREDONDO and C.-P. FRITZEN

ABSTRACT

Acoustic Emission (AE) based techniques are used for the non-destructive inspection of mechanical structures in order to detect very early stage damage before a structure completely fails. The detection and accurate localization of these emissions are essential to provide a reliable fault monitoring and become the backbone for the application of trustworthy quantitative methods for source mechanism characterization. Error analysis is then fundamental for the evaluation of the accuracy and reliability of localization results. In this paper a review of the main analysis techniques is presented and several methods including multiresolution analysis, quadratic time-frequency energy analysis, entropy based onset time detectors and artificial neural networks are used and evaluated. Experiments have been performed by means of simulated sources on the surface of an isotropic plate-like structure using a network of broadband acoustic emission sensors and the spatial localization errors were analyzed. In the end, a method joining different techniques is proposed for providing automatic source location with a very high accuracy.

INTRODUCTION

Acoustic emission testing (AET) has started to play an important role as a specialized technique among non-destructive methods thanks to the development of fast data acquisition systems and the increase of processors computational power. AET most important attribute, which relies on the observation of real time damage processes in a material without any external disturbance to the specimen, makes this technique a valuable tool in order to get information regarding the origin and importance of a discontinuity in a structure

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