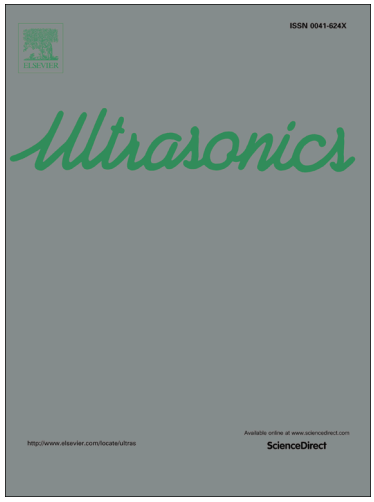

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E. Agletdinov, E. Pomponi, D. Merson, A. Vinogradov

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A Novel Bayesian Approach to Acoustic Emission Data Analysis

E. Agletdinov[1], E. Pomponi[2], D. Merson[1] and A. Vinogradov[3,1]

[1] Institute of Advanced Technologies, Togliatti State University, 445667, Russia
[2] Department of Data Science and Analytic, CGnal s.p.a., Via Carducci 38, 20122 Milano, Italy
[3] Norwegian University of Technology – NTNU, Trondheim, Norway

Acoustic emission (AE) technique is a popular tool for materials characterization and non-destructive testing. Originating from the stochastic motion of defects in solids, AE is a random process by nature. The challenging problem arises whenever an attempt is made to identify specific points corresponding to the changes in the trends in the fluctuating AE time series. A general Bayesian framework is proposed for the analysis of AE time series, aiming at automated finding the breakpoints signalling a crossover in the dynamics of underlying AE sources.

Keywords. Bayesian probability; signal processing; random time-series; acoustic emission

1. Introduction

An Acoustic Emission (AE) technique reflecting the dynamic behaviour of defects in solids has long been recognized as a powerful means for assessment of structural integrity and non-destructive characterization of deformation and fracture processes under load. The elastic waves whose frequency fall in the ultrasonic frequency range arise from the spontaneous stress release from the solids under load. The AE transient signals with random amplitudes emerge at random times, thus forming a random time series. In a wealth of other non-destructive techniques (NDT), the AE is unique in that it is capable of real time monitoring of in-service equipment [1]. Although signal analysis has been a longstanding concern in AE research, a decision-making process, which is based on AE information, is, however, far from straightforward and is still performed mostly qualitatively [2]. In view of the fluctuating nature of the AE signal,