Geophysical Research Abstracts
Vol. 16, EGU2014-11199, 2014
EGU General Assembly 2014

Sonification of acoustic emission data

Manuel Raith (1) and Christian Große ()

(1) Lehrstuhl für Zertstörungsfreie Prüfung, Technische Universität München, München, Germany (manuel.raith@tum.de),
(2) Lehrstuhl für Zertstörungsfreie Prüfung, Technische Universität München, München, Germany (manuel.raith@tum.de)

While loading different specimens, acoustic emissions appear due to micro crack formation or friction of already existing crack edges. These acoustic emissions can be recorded using suitable ultrasonic transducers and transient recorders. The analysis of acoustic emissions can be used to investigate the mechanical behavior of different specimens under load. Our working group has undertaken several experiments, monitored with acoustic emission techniques.
Different materials such as natural stone, concrete, wood, steel, carbon composites and bone were investigated. Also the experimental setup has been varied. Fire-spalling experiments on ultrahigh performance concrete and pullout experiments on bonded anchors have been carried out. Furthermore uniaxial compression tests on natural stone and animal bone had been conducted. The analysis tools include not only the counting of events but the analysis of full waveforms. Powerful localization algorithms and automatic onset picking techniques (based on Akaikes Information Criterion) were established to handle the huge amount of data. Up to several thousand events were recorded during experiments of a few minutes. More sophisticated techniques like moment tensor inversion have been established on this relatively small scale as well. Problems are related to the amount of data but also to signal-to-noise quality, boundary conditions (reflections) sensor characteristics and unknown and changing Greens functions of the media.
Some of the acoustic emissions recorded during these experiments had been transferred into audio range. The transformation into the audio range was done using Matlab. It is the aim of the sonification to establish a tool that is on one hand able to help controlling the experiment in-situ and probably adjust the load parameters according to the number and intensity of the acoustic emissions. On the other hand sonification can help to improve the understanding of acoustic emission techniques for training purposes (students, co-workers). On goal is to establish a real-time frequency transformation into the audio range to avoid time consuming visual data processing during the experiments. It is also the intention to analyze the signals using psycho-acoustic methods with the help of specialists from electrical engineering.

Reference:
Raith, Manuel (2013). “Schallemissionsanalyse bei Pulloutexperimenten an Verbunddübeln“ Masterarbeit. Technische Universität München, Lehrstuhl für Zerstörungsfreie Prüfung.
Malm, Fabian (2012). “Schallemissionsanalyse am humanen Femur” Masterarbeit. Technische Universität München, Lehrstuhl für Zerstörungsfreie Prüfung.
Richter R. (2009): Einsatz der Schallemissionsanalyse zur Detektion des Riss und Abplatzungsverhaltens von Beton unter Brandeinwirkung. Diplomarbeit. Materialprüfungsanstalt Universität Stuttgart

Keywords:
Acoustic emission, bonded anchors, femur, pullout test, fire-spalling