



High-order statistics as a tool for automatic determination of sign and arrival time of acoustic emission signals

T. Lokajicek, K. Klima

Geological Institute, Academy of Sciences of the Czech Republic, (elmes@seznam.cz / Phone: +420-224239102)

One of the fundamental problems in nondestructive testing, rock mechanics and seismology is the precise determination of the first arrival (time and sign) of acoustic (ultrasonic) emission (AE) signals (or seismic signals) recorded by multichannel systems. The knowledge of this time is very important, mainly in the case of localization of individual AE events, to determine clustering of AE events or to use data obtained for further analysis as structure determination, foci clustering, etc. The knowledge of the sign of the first arrival is very important for the determination of the fracturing mechanism of loaded rock samples, respectively. New multichannel AE recording systems are able to record huge amount of acoustic emission data. This high quantity of data requires very fast, automatic and precise first arrival and signal sign identification software. In our contribution, an approach based on high-order statistics (HOS), which is able to carry out precise arrival time determination and sign of the first arrival without human intervention is presented. The algorithm uses changes of HOS parameters as skewness, kurtosis and empirical moments of fifth and sixth order of individual AE signals. The approach was tested on real AE data, which were recorded by Vallen 8 channel recording system. This simple, accurate and quite fast method seems to be predetermined to be used in automatic processing of transient data, as acoustic emission, seismic signals, ultrasonic sounding, etc.