Stress diffusion in AEs in granitic rocks under static and dynamic loading

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Scale invariance is a basic feature to characterize the space/time/size distributions of earthquake and acoustic emission (AE) in rock under stress. A better understanding of how space-time domains link together is helpful to development dynamical model of earthquake distributions. We used a new method to calculate the average rate of events (after shocks), occurring in a space-time windows of size (L,T) at a distance r away and delay t after any event (main event).This method is applied to the analysis of the acoustic emission events in several granitic rocks under static and dynamic loading. We observed a diffusion process of temporally correlated AE activities indicating a stress diffusion mechanism, involving propagation on the heterogeneous fractal microcrack network.

Scale invariance is a basic feature to characterize the space/time/size distributions of earthquake and acoustic emission (AE) in rock under stress. Unfortunately, only little work has been dedicated to looking at the general space-time-size invariance of seismic system. A better understanding of how space-time domains link together is helpful to development dynamical model of earthquake distributions. To do this a complete data set of detailed space-time distribution is required. However, in most instrumental catalog of earthquakes the data set is often not complete for small events. In laboratory study, following the development of fast data acquisition system, a complete data set of microcracking events can be obtained (Lei et al. 2000). It is possible to model dynamically the microcracking distributions based on the experimental data. We developed the method proposed by Marsan et al. (1999) to calculate the average rate of events (after shocks), occurring in a space-time windows of size (L,T) at a distance r away and delay t after any event (main event).This method is applied to the analysis of the acoustic emission events in several granitic rocks under static and dynamic loading.

We observed a diffusion process of temporally correlated acoustic emission (AE) activities in granitic rocks under static and dynamic loading. This result indicates a stress diffusion mechanism, involving propagation on the heterogeneous fractal microcrack network. The parameters modeling the stress diffusion process are functions of rock heterogeneity and loading conditions. The diffusion process shows also a multi-hierarchical changing during the fracturing of rock sample. The parameter set as a whole can characterize the stress status in rock better than each individual parameter. If the dynamic model can be also found for the 'natural seismicity system' the model parameters might be strong dependent on the structure of the local fault system.

[Reference]

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