NUMERICAL SIMULATION OF DYNAMIC RUPTURE OF SHEAR SLIDING USING A STICK-SLIP SOURCE MECHANISM

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A theoretical model of fault behaviour and crack dynamics, represented by a numerical scheme, is presented herein. The numerical model is based on the simple theory of stick-slip motion that may describe the source mechanism for earthquakes. Preliminary results, of the simulation of the source mechanism, are presented using a rock sample with a simulated fault. The rock is modeled numerically by Discrete Element Method (DEM). The numerical examples show interesting characteristics of the precursory phenomena before an earthquake, called nucleation process. This phenomenon is shown as a series of small earthquakes viewed as a local dynamically propagating slip failure.

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Preliminary results, of the simulation of the source mechanism of a theoretical fault, are presented using a rock sample with a simulated fault. The rock is modeled numerically by Discrete Element Method (DEM) which consists in the representation of solids modeled by an array of normal and diagonal elements linking lumped nodal mass. A dynamic analysis is performed using explicit numerical integration in the time domain

The numerical examples show interesting characteristics of the precursory phenomena before an earthquake, called nucleation process. This phenomenon, considered the key to successful earthquakes prediction, is shown as a series of small earthquakes viewed as a local dynamically propagating slip failure.

The stick-slip motion due to slowly increasing shear stress at the interface seems to be adequately predicted by the model. At this stage of development there is ample evidence that the approach may provide credible representation of the source mechanism of a fault and consequently successful simulation of earthquakes. Such capability should lead in the future to significant improvement in seismic reliability analysis and help to understand the basic physics of real ground motion.