Earthquake Modeling

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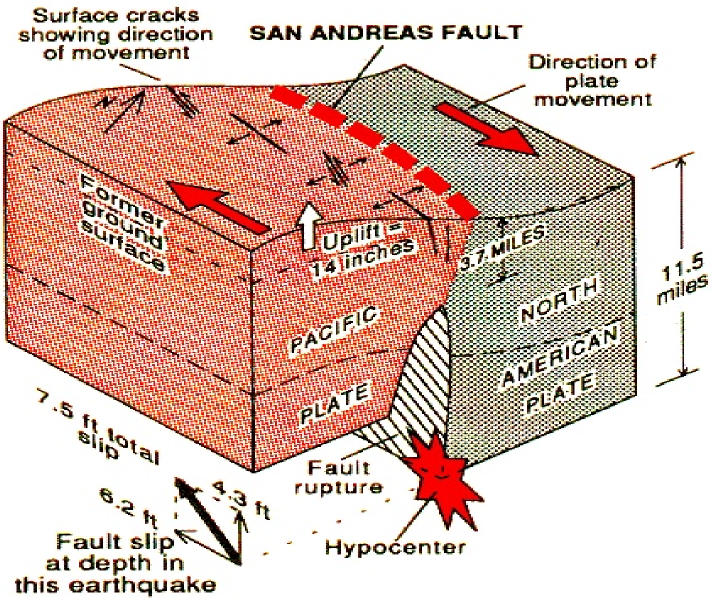
An accurate numerical simulation of earthquakes requires a comprehensive understanding of the initiation, the propagation and the healing of earthquake ruptures on active faults. One of the most popular active faults in the world is the San Andreas fault (SAF) in California, see the figure below.



Its notoriety comes partly from the disastrous 1906 San Francisco earthquake, but rather more importantly because it passes through California, a highly-populated state that is frequently in the news.

The governing equations are the linear elastodynamics equations, but are coupled along the fault by highly non–linear frictional laws. The linear elastodynamics equations model propagation of pressure and shear waves in the earth, and is the basic model used in earthquake simulations. The frictional laws model the relative motion of the Pacific plate and the North American plate along the fault.

The ultimate goal of this project is to discretize the equations with high order finite difference approximations, and investigate how non-standard boundary/interface conditions, relevant for this particular application, should be discretized. The gist is to use high order summation–by–parts operators and impose the boundary/interface conditions using penalty techniques. The energy method will be used to prove stability. During the project, there may be an opportunity to collaborate with geophysicist from Stanford University.