A New Fully-Dynamic Earthquake Cycle Simulator Applicable to Arbitrary Nonplanar Fault Geometries - A Benchmark Test

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The models and data assimilations of the real earthquake cycles are now getting on the track for providing the data beyond the classical empirical laws in the context of the seismic hazard; an example can be seen in the Third California Earthquake Rupture Forecast (UCERF3). Such large modeling is enabled by the rapid development of the earthquake simulators capable of solving the earthquake cycles in the real fault systems (Barbot et al., 2012: Richards-Dinger and Dieterich, 2012). However, there is not a fully dynamic cycle simulator applicable to wide tectonic conditions yet. The applicability of earthquake cycle simulators is thus still largely restricted.

In this research, we propose a new earthquake cycle simulator applicable to arbitrary nonplanar fault geometries. This simulator is based on the fast domain partitioning hierarchical matrices (FDP=H-matrices) (Sato and Ando, 2018), a newly developed algorithm of quasilinear time for dynamic BIEM applicable to nonplanar fault geometries. This cycle simulator thus overcomes the restriction on geometries when solving the elastodynamic fault motions in the coseismic phase, which had been the intrinsic problems for previous methods to solve the dynamic ruptures. In the presentation, after proposing the new method, we run a benchmark test of the SCEC Sequences of Earthquakes and Aseismic Slip project (SEAS) by the new simulator. Obtained results are compared with those of the previous simulators such as ByCycIE (Lapusta et al., 2000) and other simulators of volume-based methods. Simulated cycles on other nonplanar faults will be also demonstrated.

Keywords: Fully-Dynamic Earthquake Cycle Simulator, Nonplanar Fault Geometries (Subduction Zones + Ground Surfaces and Inland Faults), SCEC Sequences of Earthquakes and Aseismic Slip project (SEAS)

