Irikura Recipe Method 1:

A Hybrid Approach Combining Irikura Recipe Rupture Model and GP Ground Motion Simulation Procedure

Arben Pitarka (pitarka1@llnl.gov) Lawrence Livermore National Laboratory, Livermore, CA, USA

National Research Institute for Earth Science and Disaster Resilience (NIED) (j-shis@bosai.go.jp)

Release Notes (V.19.4)

- Kinematic Rupture Generator Code (gen_srf_4.9.1):

The kinematic rupture generator code is based on the Irikura Recipe (Irikura and Miyake, 2011). The rupture generator includes two minor modifications to the Irikura Recipe:

1. In the original Recipe the rupture velocity V_r is fixed at $V_r=0.72*V_s$, where V_s is the shear wave velocity. In our code V_r is an input parameter that should be set by the user. We recommend $V_r=0.8*V_s$.

2. The minimum distance between the asperity and top edge of the fault is set to 2km, instead of 3km, originally recommended by the Recipe.

- Low and High Frequency Simulation Codes:

The low and high frequency parts of simulated ground motion are computed using the current version of the GP simulation procedure (V.19.4).

Method Overview

The broadband ground motion simulation procedure is identical to the GP hybrid procedure, available on the SCEC BB Platform, which computes the low frequency and high frequency ranges separately and then combines the two to produce a single time history of ground motion acceleration (Graves and Pitarka, 2015;2016).

The kinematic rupture model is generated using the Irikura Recipe (Irikura and Miyake, 2011; Iwaki et al., 2016) (IM2011, hereafter). IM2011 is based on the multiple-asperity concept of fault rupture. This concept is an extension of the single-asperity model of Das and Kostrov (1986). IM2011 uses three sets of parameters, named outer, inner and extra fault parameters, to characterize the fault rupture kinematics. The outer parameters characterize the rupture area and magnitude, and the inner parameters define the spatial and temporal characteristics of slip distribution determined from estimated stress drop in the asperities and background areas of the fault. The extra fault parameters are the rupture nucleation location, rupture initiation point in each asperity, and rupture velocity. The outer and inner fault parameters are linked to the total seismic moment following empirical scaling laws. The number of asperities, total asperity area, and asperity slip contrast follows Somerville et al. (1999). In IM2011 the asperities are rupture areas with both high slip (higher static stress drop) and high slip-rate (shorter slip duration). This means that most of the strong shaking energy is generated in the asperity areas, which cover only a small part of the total fault area. Our hybrid approach has been validated against recorded data, results obtained with other simulation methods, and GMPEs (e.g. Pitarka et al., 2017).

Our rupture generator code is also used by the Irikura Recipe 2 method, available on the SCEC BB Platform (V.19.4)

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