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Dynamic rupture propagation on a bimaterial strike-slip fault and resulting strong ground motion

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Large faults with a long slip history often separate rocks of dissimilar elastic properties. Such bimaterial interfaces have been reported to exhibit remarkable dynamic properties in the 2D in-plane case that may be relevant to many issues of earthquake rupture dynamics. Slip along a bimaterial interface generates dynamic changes of normal stress, modifying the local fault strength. The general result is a non-symmetric dynamic propagation of rupture even with a homogeneous initial stress.

Here we present results of a numerical investigation of dynamic bimaterial ruptures in 3D with heterogeneous initial stress on a strike-slip fault extending the parameter range and resolution of previous studies. We investigate the influence of the bimaterial mechanism on the resulting strong ground motion.

We classify the simulations by analyzing the resulting strong ground motion as well as various aspects of rupture propagation on the fault. E.g., a class of parameter cases for which the bimaterial mechanism changes the final slip distribution on the fault by a small amount only (change of correlation coefficient < 2%) while at the same time it changes peak ground velocity and peak ground acceleration dramatically (change of PGV & PGA > 100%). This reflects the fact that the bimaterial mechanism can introduce a large change in the slip-velocity history on the fault. In another class of results the bimaterial mechanism changes the final slip distribution considerably in the sense that the resulting earthquakes can differ by an order of moment magnitude.