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# Rupture dynamics and geometrical evolution of wavy faults

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http://www-solid.eps.s.u-tokyo.ac.jp/˜ando/

Natural faults have wavy geometry in a wide spectrum of scale. It is known that the kinked parts of faults suppress slip and control the propagation of ruptures beyond these points. Therefore, understanding the behavior of fault kinks is necessary to understand the earthquake events propagating through multiple fault segments. Since the kinks in wavy faults cause the intensified concentration of stresses around them, the nucleation of secondary faults or branches are expected from the kinks, which can contribute to the interactions between fault segments during dynamic ruptures. In order to analyze these problems we use a newly developed boundary integral equation method (BIEM) that can unify the dynamic and static analyses, which are capable of the of full dynamic modeling of rupture on non-planar faults as well as quasi-static modeling during a seismic cycle. By the simulations, we confirm that off-fault stresses can be accumulated around the kinks associated with recurrent slip events on the faults, and then the concentrated stress eventually triggers the formation of new branch faults. These branches are shown to dynamically propagate cutting through preexisting wavy geometry. Since pinning of slip at kinks is avoided by this event, the released moment become much larger than those of previous events propagating on preexisting wavy fault. This result suggests that non-planar fault geometry is essential for the segmentation and interaction of earthquake rupture, which depends on the history of geometrical evolution of faults. In addition our study explains interesting co-seismic and tectonic phenomena such as off-fault aftershocks, flattening of fault plane with increasing slip, and variation in directivity and paths of ruptures from one event to the next.