

Galerkin boundary integral equation method for spontaneous rupture propagation problem

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We develop a Galerkin finite element boundary integral equation method (GaBIEM) for spontaneous rupture propagation problems for a planar fault embedded in a homogeneous full 2D space. A 2D antiplane rupture propagation problem, with a slip-weakening friction law, is simulated by the GaBIEM. This method allows one to eliminate the strong singularities from the integral representation of the traction, and to separate explicitly the expression for the traction into an instantaneous component; static and time-dependent components with weakly (logarithmic) singular kernels; and a dynamic component and a quasi-static component, with continuous, bounded, kernels.

Simulated results throw light into the performance of the GaBIEM and highlight differences with respect to that of the radiational, collocation, boundary integral equation method (BIEM). Both methods converge with a power law with respect to grid size, with different exponents. There is no restriction on the CFL stability number for the GaBIEM since an implicit, unconditionally stable method is used for the time integration. The error of the approximation increases with the time step, as expected, and it can remain below that of the BIEM.