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3 次元非平面断層解析に適した動的境界要素法の領域分割法による高速化
Efficient Domain Partitioning Method for Dynamic BIEM applicable to Non-planar Faults

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The boundary integral equation method (BIEM) is a powerful tool to analyze the earthquake rupture dynamics on non-planar faults. The non-planar fault analysis requires of the boundary integral equations (BIEs) that they are formulated in the real space and time domain, while those formulate in the spectral domain are limited to the application of the planar fault geometry. However BIEM in the space-time domain has extremely large numerical costs. Due to such large costs particular for the memory requirement, efficient use of the memory storage of the integration kernel have not be possible. In this study, we develop a new method to reduce the calculation time and memory requirement greatly without degrading the accuracy in 3-D. We extend the method proposed by Ando et al. (2007) in 2-D. This method divide the causality cone appealing in the integration kernel to the domains related to the wave fronts, the near-field term and the static term. We implement the algorithm on K-computer, and demonstrate the memory storage of the integration kernel becomes possible on the currently available computational environment owing to the reduced memory requirement. This contributes the efficiency of the numerical analysis considerably. For example, by using the same 6400 nodes, the analysis of the model consisting of 160 thousands fault elements and 1600 time steps took about a half year with the original method, however it is reduced to about two hours with the current efficient method. The current method is also shown to be scalable on distributed memory environment to the scale of these nodes. This method is expected to break through the emerging limitations of the dynamic earthquake rupture simulations with realistic 3-D geometrical models, and will contribute to widen the spectrum of the applicational works using the dynamic simulations.

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