Fast and scalable finite-element solvers for three-dimensional urban earthquake simulation

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Considering the effect of 3D heterogenous underground structure and surface topography is important for improving reliability of earthquake response simulation of urban areas. Furthermore, consideration of coupling between ground and structure is desired for improving reliability of simulation results for highly important structures. The finite-element method with unstructured 3D solid elements is suitable for these simulations as it can model problems with complex geometry and heterogeneous material properties. However, its large computational cost has limited it from being used in large-scale seismic applications. To overcome this situation, we are developing fast and scaleble finite-element solvers for large-scale supercomputer systems. In this talk, we will show our development of the finite-element solvers and show some examples of urban earthquake simulation on the K computer at RIKEN (82944 compute-node 10 PFLOPS system) and the Intel Xeon Phi based Oakforest-PACS system at Joint Center for Advanced High Performance Computing (8192 compute-node 25 PFLOPS system).

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