Colloquium

A geometric multigrid preconditioner for microFE analysis for bone structures based on a pointer-less octree

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Abstract: The state of the art method to predict bone stiffness is micro finite element (microFE) analysis based on high-resolution computed tomography (CT). Modern parallel solvers enable simulations with billions of degrees of freedom. In this talk we present a solver that works directly on the CT-image and exploits the geometric properties given by the 3D-pixel. The data is stored in a pointer-less octree. The tree data structure provides different resolutions of the image that is used for the design of a geometric multigrid preconditioner. It makes possible the use of matrix-free implementations on all levels. This new solver reduces the memory footprint by more than a factor of 10 compared to a solver that uses an algebraic multigrid (AMG) preconditioner. It allows to solve much bigger problems and scales excellently on a Cray XT-5 Supercomputer.

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