The U.S. Department of Energy Grand Challenge in Computational Accelerator Physics*, S. HABIB, R. RYNE, LANL; K. KO, Z. LI, W. MI, C. NG, M. SAPAROV, V. SRINIVAS, Y. SUN, X. ZHAN, SLAC - Future particle accelerators will play a major role in solving problems of international importance, including the clean-up and destruction of nuclear waste, the production of tritium, and the production of energy. The next generation of accelerators will also be crucial to advances in basic and applied science, in areas such as high energy physics, materials science, and biological science, through the development of linear colliders and spallation neutron sources. The design of accelerators for all of these projects will require a major advance in numerical modeling capability, due to extremely stringent beam control and beam loss requirements, and the presence of highly complex three-dimensional accelerator components. As part of the U.S. Department of Energy High Performance Computing and Communications program, a Computational Accelerator Physics "Grand Challenge" was approved in 1997. The primary goal of this project is to develop an advanced, parallel modeling capability, based on High Performance Computing and Communications resources and state-of-the-art numerical methods and algorithms, that will enable the design, optimization, and numerical validation of future accelerators for the above-mentioned projects. In this paper we will report on our progress to date, including two specific examples: (1) parallel Particle-In-Cell simulations for the APT program with up to 100 million particles using a new 3D linac simulation code, and (2) parallel electromagnetics simulations of an entire 206-cell accelerating section for the NLC program using a new finite element code.

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