Challenges in Code Development for Parallel and Multimechanics Contact

*Michael Puso, Tony Degroot, Robert Ferencz, Dennis Parsons, Jerome Solberg, Ed Zywicz

Lawrence Livermore National Laboratory
8000 East Ave, Livermore CA, 94550
puso@llnl.gov
https://www-eng.llnl.gov/mdg/people.html

Key Words: *Contact, Parallel, Multimechanics*

ABSTRACT

The Methods Development Group at Lawrence Livermore National Laboratory has historically developed and supported software for engineering simulations, with a focus on nonlinear structural mechanics and heat transfer. The quality, quantity and complexity of engineering analyses have continued to increase over time as advances in chip speed and multiprocessing computers have empowered this simulation software. As such, the evolution of simulation software has seen a greater focus on multi-mechanics and the incorporation of more sophisticated algorithms to improve accuracy, robustness and usability. This talk will give an overview of the latest contact technologies developed by the Methods Development group in the areas of large deformation transient analysis and implicit coupled codes. Applications were run on the state of the art hardware available at the National Labs.

First, the algorithms related to explicit transient dynamic analyses and their parallelization will be presented. Here, the main focus is on dynamically defined contact (i.e. evolving contact surfaces, dynamic partitioning). Applications include penetration and automobile crash analyses.

Second, recent accomplishments in coupled code development will be discussed. The main focus here will be on implicitly integrated coupled solid, thermal and electro-magnetics. Classical node-on-segment contact algorithms are typically not robust, particularly for implicit structural mechanics and electro-magnetics. As, such segment-to-segment mortar methods have been applied to solid, thermal and electromagnetic contact. An overview of the coupled non-linear solution techniques used for the coupled systems will be given. Results in the area of rail gun and reactor technology will be presented.