Matrix Computations & Scientific Computing Seminar

Organizer(s): James Demmel, Ming Gu & Beresford Parlett

Wednesday, 11:00am–12:00pm, 380 Soda

Nov. 25 **Tyler (T.J.) Alumbaugh**, Lawrence Livermore National Lab
Load-balancing Multiphysics Simulations

Many physical systems of interest can be described as coupled sets of partial differential equations (PDEs) defined over some physical domain and described with certain boundary conditions and initial conditions. These systems typically have no analytical solution, so they are discretized in time and space, and their solution depends on efficient numerical solvers. Often, the resulting computational work is so large that it is decomposed along spatial boundaries and the solvers then execute in a parallel setting.

However, a decomposition that evenly divides work for one PDE solver may not evenly distribute work for another PDE solver in the system. This brings the familiar problem of "load imbalance" or an unequal distribution of work, and the undesirable consequence of processors with a small amount of work sitting idle and waiting on the processor with the greatest amount of work.

We present a technique to balance the work load of a Lagrangian computational fluid dynamics solver (which uses a finite volume scheme) coupled to a photon transport solver (which uses a Monte Carlo technique) in the context of simulated laser experiments. We discuss some speedup results and conclude with ideas for future work.

Short bio for T.J.:

T.J. Alumbaugh is a computer scientist at Lawrence Livermore National Laboratory. He has bachelors in Computer Science and Mathematics and a masters in Computer Science from the University of Illinois at Urbana-Champaign. T.J. specializes in software for highly parallel physics simulations. He previously worked as a researcher at the Center for the Simulation of Advanced Rockets in Champaign, Illinois, and currently leads a software development team that assists with the design of physics experiments at the National Ignition Facility.