GPU Technology Conference, May 14-17, 2012
McEnery Convention Center, San Jose, California
www.gputechconf.com

Sessions on Computational Structural Mechanics (subject to change)

IMPORTANT: Visit http://www.gputechconf.com/page/sessions.html for the most up-to-date schedule.

S0431 - Evolving Use of GPU for Dassault Systems Simulation Products
Matt Dunbar (Dassault Systemes, SIMULIA)
Day: Wednesday, 05/16 | **Time:** 9:00 am - 9:25 am
Topic Areas: Computational Structural Mechanics; Parallel Programming Languages & Compilers
Session Level: Intermediate

SIMULIA, the Dassault Systems brand for simuliation, has been working with NVIDIA GPGPU cards to accelerate the computation required in doing large-scale structural finite-element simulations with the widely used Abaqus product line. SIMULIA's initial efforts with GPGPU's have been focused on accelerating particularly costly parts of the code when running both on workstations and clusters. We will look at success in these areas with existing products. Further, SIMULIA is now looking at how evolving programming models like OpenACC open the door to using GPU's as a compute platform more than acceleration for limited parts of an application.

S0225 - Speedup Altair RADIOSS Solvers Using NVIDIA GPU
Eric Lequiniou (Altair), Hongwei Zhou (Altair)
Day: Wednesday, 05/16 | **Time:** 9:30 am - 9:55 am
Topic Areas: Computational Structural Mechanics
Session Level: Beginner

Solvers are the heart of Altair's HyperWorks computer aided engineering simulation software. In this session, you will learn how GPU can improve their performance. Direct solver is widely used in structural analysis and sensitivity calculations. By offloading the intensive matrix computation on the GPU and using heterogeneous computing, you will discover how its speed can be increased compared to multi-core approach. Iterative solver is particularly suited to solve large problems with millions of degrees of freedom. An innovative hybrid parallelization using multi GPUs and MPI allowing dramatic solution time reduction will be presented.

S0064 - MD.Nastran Sparse Direct Solvers for Tesla GPUs
Cheng Liao (MSCsoftware)
Day: Wednesday, 05/16 | **Time:** 2:00 pm - 2:25 pm
Topic Areas: Computational Structural Mechanics
Session Level: Beginner

The current implementation of MD.Nastran's MSCLDL and MSCLU sparse direct solvers for multiple Tesla GPUs is presented. The matrix is first statically decomposed into a prescribed number of domains. The Schur compliments are then calculated with CPUs and GPUs, and the residual structure is solved afterward. Back-substitution is used to find the solution at every grid point. Merits of this method are discussed and performance comparisons are made.

S0143 - Fluid-Structure-Interaction Using SPH and GPGPU Technology
Jean Luc Lacome (IMPETUS Afea SAS), Jerome Limido (IMPETUS Afea SAS)
Day: Wednesday, 05/16 | **Time:** 2:30 pm - 2:55 pm
Topic Areas: Computational Structural Mechanics; Algorithms & Numerical Techniques; Computational Fluid Dynamics
Session Level: Intermediate

There are two goals when developing engineering analysis software, one is accuracy and the other is speed. In the area of Fluid-Structure Interaction (FSI) computational time has always been the major impediment to solving large realistic engineering problems. In our implementation the fluid/structural dynamics solver uses a combination of GPU/CPU processing. The added benefit of using a powerful GPU workstation is that it is roughly 10 times less expensive than a regular CPU cluster. In this paper, we present the use of GPU Technology as implemented in the explicit dynamic finite element software IMPETUS Afea Solver®.

S0214 - GPU Based Stacking Sequence Optimization For Composite Skins Using GA
Sathya Narayana K. (Infosys Ltd.), Ravikumar G.V.V. (Infosys Ltd., Bangalore)
Day: Wednesday, 05/16 | **Time:** 3:00 pm - 3:25 pm
Topic Areas: Computational Structural Mechanics; Algorithms & Numerical Techniques; Parallel Programming Languages & Compilers; Algorithms & Numerical Techniques
Session Level: Advanced

The goal of this session is to showcase how GPUs can be used to achieve high performance in a Genetic algorithm based optimization. The particular domain applied is stacking sequence optimization of Aircraft wing skins. The concepts illustrated use CUDA but are generic to any other GPU language. It is assumed that the registrants have exposure to optimization in engineering domain.

S0055 - Particle Dynamics with MBD and FEA Using CUDA
Graham Sanborn (FunctionBay)
Day: Wednesday, 05/16 | **Time:** 4:00 pm - 4:25 pm
Topic Areas: Computational Structural Mechanics; Computational Physics; Computational Fluid Dynamics
Session Level: Intermediate

Many sphere particles are solved with DEM (Discrete Element Method) and simulated with GPU technology. Fast algorithm is applied to calculate hertzian contact forces between many sphere particles (from 100,000 to 1,000,000) and NVIDIA's CUDA is used to accelerate the calculation. Many sphere particles and MBD and FEA entities are simulated within commercial software RecurDyn. Many models are built and simulated; fork lifter with sand model, oil in oil tank model, oil filled engine system and water filled washing machine model. All models are simulated with NVIDIA's GPU and the result is shown.

S0070 - GPU-Friendly Preconditioners for Thin Structure Analysis
Krishnan Suresh (University of Wisconsin)
Day: Wednesday, 05/16 | **Time:** 4:30 pm - 4:55 pm
Topic Areas: Computational Structural Mechanics; Algorithms & Numerical Techniques
Session Level: Intermediate

The goal of this session is to identify a niche area within computational structural mechanics, namely finite element analysis of thin structures (such as beams, plates and shells) where GPU computing can make a significant impact. We will discuss methods for: (1) extracting equivalent lower-dimensional models from complex 3-D structures, and (2) using these lower-dimensional models as pre-conditioners for a full 3-D finite element analysis on the GPU. It is assumed that registrants are familiar with finite element analysis, and some of the underlying challenges.

S0518 - GPU Computing: From Sand to Tank Dynamics
Dan Negrut (University of Wisconsin-Madison)
Day: Wednesday, 05/16 | **Time:** 5:00 pm - 5:25 pm
Topic Areas: Computational Structural Mechanics; Computational Fluid Dynamics
Session Level: Advanced

This talk explores the use of heterogeneous CPU/GPU computing, as enabled by an in-house developed Heterogeneous Computing Template (HCT), for physics-based simulations of mechanical systems. HCT draws on five components: advanced modeling techniques (formulating the governing equations); algorithmic support (solving these equations); proximity computation; domain decomposition/data exchange (for multi-node distributed CPU/GPU computing); and post-processing/visualization. These five components provide the foundation of a computational framework used to analyze mechanical systems with millions of interacting elements. Example applications will include granular terrain simulation, tracked and wheeled vehicle mobility studies (tanks, rovers), fluid-solid interaction and nonlinear finite element analysis.