Toward High-Performance Computing Support for the Simulation and Planning of Robot Contact Tasks

Jeff Trinkle and Chris Carothers, RPI CS, Troy NY, USA
Dan Negrut, ME, U. of Wisconsin, Madison, Wisconsin, USA
Workshop Goals

• **Day 1** – Assess the state of the art and future needs in multibody simulation with contact.
  – Simulation capabilities
  – Future needs in robotics, engineering, games, etc.
  – Guidelines for model/method selection

• **Day 2** – Discuss the possibility of an open-source tool with 24/7 support offered on a HPC platform.
  – Possible break-out groups:
    • Software base and user support
    • Hardware and platforms
    • Validation and benchmarks
  – Possibly apply for NSF Community Infrastructure – Acquisition, Development, Deployment, and Operation grant
Computer Science

Challenges for Simulator Users

• My group compared dVC3d to Bullet.
• We could not stabilize Bullet.
• Could a support infrastructure have solved this?
• Which model/simulator should I use for my problem?
Engineering Analysis with Chrono Engine
Kinematic/Quasistatic Model

- Folding planning
  - Cloth is rigid panels connected by revolute joints
  - Who would have chosen rigid models with gravity bending
Morning Schedule 27, June

• 9:00 – 10:30: Session 1: Oral Presentations
  – 9:00: Erwin Coumans (AMD), “OpenCL accelerated rigid body dynamics and collision detection.”
  – 10:00: Dan Negrut (ME, Wisconsin), “Enabling high performance computational dynamics in a heterogeneous hardware ecosystem.”

• 10:30-10:35: Poster Teasers:
  – Drumwright, Goldman, Moisio, Mazhar, Schindler

• 10:35 – 12:00 Session 2: Poster Presentations
• 12:00 – 13:30 Lunch
• 13:30 – 15:00 Session 3: Oral Presentations
Early Afternoon Schedule 27, June

• 13:30 – 15:00: **Session 3: Oral Presentations**
  – 14:00: **Dinesh Manocha** (UNC), “Real-time collision and contact computations using multi- and many-core processors.”

• 15:00 – 15:30: **Coffee**

• 15:30 – 17:00: **Session 4: Oral Presentations**
Late Afternoon Schedule 27, June

- 15:00 – 15:30: Coffee
- 15:30 – 17:00: Session 4: Oral Presentations and Discussion
  - 15:30: Dinesh Pai (UBC), “Contact resolution with Eulerian solids simulation.”
  - 16:00: Danny Kaufman (UNC), “Moving forward in contact, impact, and dissipation: challenges and choices for computing contact-constrained trajectories.”
  - 17:00: Jeff Trinkle (RPI): Wrap-up

- TOMORROW – We start at 8:30
- 8:30 – 9:30: Session 5: Breakout Groups
  - Break-out groups: Software and support, hardware, validation and benchmarks
Morning Schedule 28, June

- 8:30 – 9:45: **Session 5: Break-out Groups**
- 9:45 – 11:00: **Session 6: Group Discussion**
- 11:00: Adjourn

- **Join RSS program**
- 11:00 – 11:30: Coffee on RSS schedule