SIGGRAPHASIA2009

Technical Papers Fact Sheet

Chair:
Nelson Max, University of California, Davis
Conference: Wednesday 16 December – Saturday 19 December
Exhibition: Thursday 17 December – Saturday 19 December

The Facts

- The SIGGRAPH Asia 2009 Technical Papers program is a premier international forum for presenting new research in computer graphics and interactive techniques in areas of physical simulation, animation control, real-time and photo-realistic rendering, geometric and urban modeling, hair capture and styling, texturing, image and video processing and resizing, GPU algorithms, and sound.
- The Technical Papers program received 274 submissions and these papers were reviewed and selected by a technical papers committee of 35 members, including technical papers chars Tony DeRose for SIGGRAPH 2010, George Drettakis, for SIGGRAPH Asia 2010, and Kurt Akeley, for SIGGRAPH Asia 2008, and also Danny Cohen-Or, Hughes Hoppe, Ming Lin, Dinesh Manocha, Ravi Ramamoorthy, and Peter Shirley.
- For the first time in SIGGRAPH history, one session of four papers includes duplicate presentations in Japanese.
- These technical papers are also published in the December 2009 issue of ACM Transactions on Graphics, which will be mailed and available online at the ACM Digital Library in early December.

A Quote from the SIGGRAPH Asia 2009 Technical Papers Chair:
"We had a relatively high acceptance rate (at least for recent SIGGRAPH conferences) of 25.5%, which translates to a very good collection of submitted papers. The technical papers to be presented cover many topics, including animation control, real-time and photo-realistic rendering, geometric and urban modeling, hair capture and styling, texturing, perception, image and video processing and resizing, and GPU algorithms. In previewing the videos to make this selection, I realized that this conference has a very exciting selection of accepted papers, particularly in the areas of simulation and animation."

SIGGRAPH Asia 2009 Technical Papers Program highlights include:

- **Skipping Steps in Deformable Simulation with Online Model Reduction**
  Theodore Kim, *University of Saskatchewan*, *Cornell University*
  Doug James, *Cornell University*

  In computer animation, deformable models could include rubber, soccer balls, and animal and human character flesh, skin, and fat layers, moving under forces from gravity, a kick, or muscles. The geometry of such models is described by many vertices, so that the motion takes place in a high dimensional space of all vertex coordinates. Often a "reduced" lower dimensional subspace of realistic motions can be discovered by extensive "offline" pre-computations. The contribution of this paper is to discover the lower dimensional subspace "online" as the simulation is progressing, from its recent history, and predict how many time steps can be replaced by simulating in this reduced space, without introducing too much error.

- **Harmonic Shells: A Practical Nonlinear Sound Model for Near-Rigid Thin Shells**
  Jeffrey Chadwick, Steven An and Doug James, *Cornell University*

  A related paper to *Skipping Steps in Deformable Simulation with Online Model Reduction*, this paper efficiently generates realistic crashing sounds for cymbals, plastic water jugs, and metal trash cans. In this case the reduced subspace consists of the fundamental modal vibrations of the linearized system. The nonlinear coupling of these modes involves an integral over all the triangles in the shell, which is efficiently approximated by considering only a few triangles, chosen (together with their weights in the sum approximating the integral) in a greedy manner to give the best approximation on a training set of motions. (This sort of integral approximation is also used in the previous paper.) In addition, the sound produced by each mode as heard at any position in space is pre-computed and stored in a collection of textures, so that the sound at any listening point can be rapidly computed.

- **Aggregate Dynamics for Dense Crowd Simulations**
  Rahul Narain and Abhinav Golas, *University of North Carolina at Chapel Hill*
  Sean Curtis , *Walt Disney Animation Studios*
  Ming Lin, *University of North Carolina at Chapel Hill*

This paper produces impressive dense crowd animations with many thousands of people walking past each other, at nearly interactive rates on desktop computers, by treating people as both individuals and as a single continuous flow. Individuals compute their desired velocities based on their goals and any obstacles. Their positions and velocities are mapped to a simulation grid to determine the density and locally averaged velocity of the crowd flow. Interpersonal separation is enforced by applying a maximum density limit on the grid through a "unilateral incompressibility" constraint, which revises grid velocities to make the most progress along the individuals' desired directions, subject to a maximum walking speed and the maximum density. Individuals' velocities and positions are then updated using these grid velocities to prevent collisions.

- **Synthetic Turbulence using Artificial Boundary Layers**
  Tobias Pfaff and Nils Thürey , *ETH Zürich*
  Markus Gross, *ETH Zürich*, *Disney Research Zürich*
  Andrew Selle, *Walt Disney Animation Studios*

  This paper gives a method of adding realistic high resolution turbulence effects to low resolution "mean flow" fluid simulations, using much less computer time than a full high resolution simulation. Flow around moving objects like automobiles or airplanes is pre-computed for a collection of different object motions, to compute "artificial boundary layers", and their turbulent transition regions, where vortex particles are to be placed. These pre-computations are appropriately interpolated for an actual object motion, and the vortex particles are placed, tracked through the flow, and used to modify the mean flow to generate the turbulence, which can be seen in animations by its swirling effects on clouds, fog, or automobile exhaust.

- **Stretching and Wiggling Liquids**
  Doyub Kim and Hyeong-Seok Ko , *Seoul National University*
  Oh-Young Song, *Sejong University*

  This paper efficiently simulates thin sheets and tubes of splashing liquids, using a fine grid near the surface of the liquid, with a coarser grid farther inside it. A vortex sheet model with added random noise makes the surface roll up and ripple realistically. "Liquid-biased filtering" makes sure that the water in the high resolution details is not lost in the processing steps on the coarser grid. Other published ideas like semi-langrangian advection, vortex confinement, and the particle level set method enhance the accuracy and realism. The presentation includes very realistic animations of milk splashing against complex objects.

- **Shadow Art**

  Niloy J. Mitra, *IIT Delhi / KAUST*

  Mark Pauly, *ETH Zürich*

  The paper *Shadow Art* gives a method of designing a 3D sculpture that casts specified shadows in three different directions. To start, the generalized cones between the light sources and the specified shadow figures are intersected to form the *shadow hull*. In general, shadows cast from the shadow hull will miss some desired pixels in the input figures. So there is method to minimally deform the input figures to improve their match to the shadows from their shadow hull. Finally, sculpting methods that preserve the cast shadows can further carve out the 3D volume.

- **Dynamic Shape Capture**

  Daniel Vlasic, *Massachusetts Institute of Technology*

  Pieter Peers, *University of Southern California*

  Ilya Baran, *Massachusetts Institute of Technology*

  Paul Debevec, *University of Southern California, Institute for Creative Technologies*

  Jovan Popović, *Massachusetts Institute of Technology, Adobe Systems Incorporated, University of Washington*

  Szymon Rusinkiewicz, *Princeton University*

  Wojciech Matusik , Adobe Systems Incorporated

  The paper *Dynamic Shape Capture using Multi-View Photometric Stereo* used controlled lighting on a dome surrounding an actor, and nine 240 frame per second video cameras around the actor, to capture images. The illumination patterns have six axis-aligned hemispheres lit in a cycle, used to determine the surface normal by shape-from-shading, together with interspersed full sphere illumination frames for determining the optical flow. This allows the surfaces constructed from the normals for each camera view to be aligned, merged, and hole-filled, to reconstructed detailed moving models at 60 frames per second (although each frame currently takes an hour to compute).

- **Sketch2Photo: Internet Image Montage**

Tao Chen & Ming-Ming Cheng , *Tsinghua National Laboratory for Information Science and Technology*
Ping Tan , *National University of Singapore*
Ariel Shamir , *Efi Arazi School of Computer Science, The Interdisciplinary Center*
Shi-Min Hu , *Tsinghua National Laboratory for Information Science and Technology*

The paper "Sketch2Photo: Internet Image Montage has received a lot of interest lately. The system it describes composes a realistic picture from a simple sketch annotated with text labels. Multiple candidate images for the background and the foreground objects are downloaded from the Internet, using the text labels in the web search. Ones with background texture unsuitable for compositing are rejected, and then candidate composites are made, using the sketch for positioning and sizing of the foreground objects. A new algorithm combining Poisson image editing with alpha matting produces the composite images. This algorithm minimizes a cost score for the quality of the seams between the foreground and background. Among the multiple composites made from the assorted candidate images, the ten with the lowest ten cost scores are presented to the user, for selection and potential interactive seam editing. With about 6 minutes of user interaction time to make the sketches, select the best result, and interactively refine it, and in about 45 minutes of total "wall clock" time, very realistic composite images can be produced.