Editorial

Parallel Graphics and Visualization

Computer Graphics and Visualization are two fields that continue to evolve at a fast pace, always addressing new application areas and achieving better and faster results. The volume of data processed by such applications keeps getting larger and the illumination and light transport models used to generate pictorial representations of this data keep getting more sophisticated. Richer illumination and light transport models allow the generation of richer images that convey more information about the phenomenons or virtual worlds represented by the data and are more realistic and engaging to the user. The combination of large data sets, rich illumination models and large, sophisticated displays results in huge workloads that cannot be processed sequentially and still maintain acceptable response times. Parallel processing is thus an obvious approach to such problems, creating the field of Parallel Graphics and Visualization.

The Eurographics Symposium on Parallel Graphics and Visualization (EGPGV) gathers together researchers from all over the world to foster research focused on theoretical and applied issues critical to parallel and distributed computing and its application to all aspects of computer graphics, virtual reality, scientific and engineering visualization. This special issue is a collection of five papers selected from those presented at the 7th EGPGV, which took place in Lugano, Switzerland, in May, 2007.

The research presented in this symposium has evolved over the years, often reflecting the evolution of the underlying systems' architectures. While papers presented in the first few events focused on Single Instruction Multiple Data and Massively Parallel Multi-Processing systems, in recent years the focus was mainly on Symmetric Multiprocessing machines and PC clusters, often also including the utilization of multiple Graphics Processing Units. The 2007 event witnessed the first papers addressing multicore processors, thus following the general trend of computer systems' architecture.

The paper by Wald, Ize and Parker discusses acceleration structures for interactive ray tracing of dynamic scenes. They propose the utilization of Bounding Volume Hierarchies (BVH), which for deformable scenes can be rapidly updated by adjusting the bounding primitives while maintaining the hierarchy. To avoid a significant performance penalty due to a large mismatch between the scene geometry and the tree topology the BVH is rebuilt asynchronously and concurrently with rendering. According to the authors, in the near future interactive ray tracers are expected to run on highly parallel multicore architectures. Thus, all results reported were obtained on an 8 processor dual core system, totalling 16 cores.

Gribble, Brownlee and Parker propose two algorithms targeting highly parallel multicore architectures enabling interactive navigation and exploration of large particle data sets with global illumination effects. Rendering samples are lazily evaluated using Monte Carlo path tracing, while visualization occurs asynchronously by using Dynamic Luminance Textures that cache the renderer results. The combined utilization of particle based simulation methods and global illumination enables the effective communication of subtle changes in the three-dimensional structure of the data. All results were also obtained on a 16 cores architecture.

The paper by Thomaszweski, Pabst and Blochinger analyzes parallel techniques for physically based simulation, in particular, the time integration and collision handling phases. The former is addressed using the conjugate gradient algorithm and static problem decomposition, while the latter exhibits a dynamic structure, thus requiring fully dynamic task decomposition. Their results were obtained using three different quad-core systems.

Hong and Shen derive an efficient parallel algorithm for symmetry computation in volume data represented by regular grids. Sequential detection of symmetric features in volumetric data sets has a prohibitive cost, thus requiring efficient parallel algorithms and powerful parallel systems. The authors obtained the reported results on a PC cluster with Infiniband and 64 nodes, each being a dual processor, single core Opteron.

Bettio, Gobbetti, Marton and Pintore describe a scalable multiresolution rendering system targeting massive triangle meshes and driving different sized light field displays. The larger light field display ($1.6 \times 0.9\,\mathrm{m}^2$) is based on a special arrangement of projectors and a holographic screen. It allows multiple freely moving viewers to see the scene from their respective points of view and enjoy continuous horizontal parallax without any specialized viewing devices. To drive this 35 Mbeams display they use a scalable parallel renderer, resorting to out of core and level of detail techniques, and running on a 15 nodes PC cluster.

Further innovative contributions to this topic will be presented at the next Eurographics Symposium on Parallel Graphics and Visualization, taking place in Crete, Greece in April 2008.

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Dirk Reiners is an Assistant Professor at the University of Louisiana, Lafayette. His interests are in software architectures and systems for large-scale interactive multi-threaded and clustered graphics systems. He has a Master and a PhD in Computer Science from the University of Technology, Darmstadt. He is the initiator and project lead for OpenSG, one of the main Open Source scenegraph systems.

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Jean Favre received his Doctor of Science degree in the EE&CS Department at the George Washington University in Washington DC where he was awarded the Presidential Merit Fellowship in 1989-92.

Dr. Favre manages many visualization R&D projects in academia and industry, with special interests in Computational Fluid Dynamics and Molecular Dynamics, large-scale visualizations, object-oriented software developments and modular visualization environments. He has contributed to the graphics community with paper reviews for the IEEE CG&A and the IEEE Transactions on Visualization and Computer Graphics, and tutorials at SIGGRAPH and IEEE Vis conferences, was co-chair of the 2001 VisSym conference, chair of the 2007 EGPGV symposium and is co-chair of the 2008 symposium.

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