Preface

Welcome to the 2001 IEEE Symposium on Parallel and Large Data Visualization and Graphics (PVG2001).

This year's proceedings are dominated by scientific applications of parallel visualization, a subject that will be explored in the panel discussion. Other noticeable trends this year are the increasing prevalence of PC graphics clusters and the use of out-of-core techniques as alternatives to traditional parallelism. The following are summary descriptions of the program presentations.

KEYNOTE ADDRESS
In keeping with this year's theme of "large data" our invited keynote address is by the research staff at Celera Genomics Corporation. This contribution (with 14 co-authors) describes their experiences developing and using visualization tools during the process of mapping the human genome, and forward-looking challenges in the emerging field of proteomics. We believe this discussion is timely and hope it will lead to future work in these areas.

VECTOR FIELD VISUALIZATION
This set of papers presents three approaches to visualizing vector fields produced by large simulations of three dimensional fluids. Cruz, Godoy, Garcia & Ramos devise a technique that captures the surface deformations of a flow field over time. The technique makes visible the stretching and folding that characterizes fluid mixing, and is demonstrated on a cluster of commodity PCs and an SGI Origin. Crossno, Angel & Munich compare three fast methods for mapping 3D vectors into color space, and apply the methods to visualizing an ocean circulation model. The methods exploit human psychophysical properties to maximize the efficiency of the color encoding. Bruckschen, Kuester, Hamann & Joy explore real time out-of-core particle tracking for large time varying vector fields. Their system runs on a commodity PC running Linux equipped with a RAID.

SURFACES AND PARALLEL RENDERING
This eclectic session begins with a paper by Dey, Giesen & Hudson that presents a Delaunay based surface reconstruction algorithm for creating polygonal models from a very large number of sample points. They employ a divide-and-conquer strategy in order to minimize memory usage. With their new method it is now possible to reconstruct a surface from one million points on a modest PC. Reinhard, Shirley & Hansen describe a parallel point projection method that may be used to increase image size and scene complexity during interactive ray tracing. They have created a parallel Render Cache and have applied it to the concept of frameless rendering. The next two papers explore parallel rendering on PC clusters. Samanta, Funkhauser & Li have developed a K-way replication scheme that distributes each 3D primitive of a scene to only K number of PCs in a rendering cluster. They show that parallel rendering efficiencies produced with small replication factors are similar to ones using full replication. Moreland, Wylie & Pavlakos present a scalable, sort-last parallel rendering system running on a PC cluster that is capable of rendering extremely large geometric models onto high-resolution tile displays. They exploit the spatial coherency of their data in order to render 120 million triangles/second on a 12 megapixel display.

SOFTWARE INFRASTRUCTURE FOR PARALLEL VISUALIZATION
In this session two frameworks are presented for visualizing large datasets. The first paper by Law, Hendendorf & Ahrens is a case study describing the use of the well-known Visualization Toolkit (VTK) software for rendering large datasets, with an application to ocean current simulations. The second paper by Bartz, Stanek, Strasser, Crisp, Gaskins, Orton, Carter, Johannsen & Trom describes the Open Source "Jupiter" toolkit, and new occlusion culling extensions for interactively rendering very large polygonal models like those typically generated by CAD-packages.

ARCHITECTURES FOR STRUCTURED VOLUME RENDERING
This session presents two architectures for ray-casting structured volume datasets. Meiöner, Grimm, Strasser, Packer & Latimer present an implementation of a parallel ray-casting algorithm on a new single-chip SIMD architecture. Concurrent ray-processing is scheduled to produce efficient memory access and the ray-casting algorithm is mapped onto the architecture to avoid floating point calculations. Lombeyda, Möll, Shand, Breen & Heirich describe a PC cluster architecture utilizing SEPIA and Volume Proteotechnology that is capable of interactively rendering large data volumes. The architecture uses dynamically-mapped associative blending operators in a sort-last configuration to merge streams of images of subvolumes rendered on separate PCs into a single stream in real-time.
Preface

PARALLELISM: RENDERING, VISUALIZATION AND LARGE DATA

The focus of this symposium has evolved over the years. The symposium began in 1993 as the Parallel Rendering Symposium (PRS) and primarily focused on parallel photorealistic rendering issues. In 1999 the symposium was expanded to include parallel volume visualization and changed its name to the Parallel Graphics and Visualization (PVG) Symposium. In 2001 the focus was expanded once again to include the newly emerging field of large-data visualization, with the new name becoming the Symposium on Parallel and Large-Data Visualization and Graphics. We kept the PVG acronym. This evolution and expansion of the symposium raises several questions. Have we expanded the focus to the point where the original PRS participants no longer feel that PVG meets their needs? Should the focus of PVG continue to expand? What should PVG’s relationship be with Eurographics Workshop on Rendering? These issues and others (e.g. the future of PVG) will be addressed by the panel.

PARALLEL ISOSURFACE AND VOLUME RENDERING

In this “compare and contrast” session three groups of authors present a snapshot of efforts to render volume data directly and as isosurfaces. The first two papers by Zhang, Bajaj, Blanke & Fussell, and Chiang, Farias, Silva & Wei use clusters of commodity PCs and address issues of parallel I/O, load balancing, data extraction and rendering. The third paper by Gao & Shen addresses the narrower problem of load balancing during the data extraction phase. They extend occlusion culling methods commonly used for polygonal models to a visibility-driven algorithm for extracting isosurfaces on an SGI Origin machine.

UNSTRUCTURED VOLUME RENDERING

The unstructured volume rendering session consists of two papers that describe different approaches to rendering large irregular meshes. Meredith & Ma compare two geometry-based hierarchy schemes for splat-based rendering and present extensions to the octree-method which they find superior. By allowing a variable error tolerance they are able to approach interactivity using a single PC. Bennet, Cook, Max, May & Williams discuss two different parallel implementations of the high-accuracy (HAIC) volume rendering system for unstructured data. The authors compare a shared memory (thread-based) approach on an SGI Origin with a distributed memory, message-passing approach on an IBM SP cluster. Neither of these methods is able to achieve interactive rendering rates.

David Breen, Alan Heirich and Anton Koning
Symposium Co-chairs