

Towards Virtual Surgery: Goals and Achievements

Roni Yagel

Department of Computer and Information Science

The Ohio State University, USA

Abstract

The fields of computer graphics, image processing, parallel algorithms, volume visualization, and virtual realities meet in some of today's most demanding applications. One such application is the simulation of surgery on a virtual patient. The patient is first 'digitized' by one of the common medical scanners such as CT, MRI, or Ultrasound. Surgery can then be planned, rehearsed, and redesigned while operating on the digital model in a non-threatening virtual environment.

While the potential benefits of the 'medical flight simulator' are immense, so are the technological barriers we confront. Some of the most demanding tasks are: the management, manipulation and display of hundreds of megabytes of data, the physically accurate simulation of tissue deformation, the modeling and rendering of phenomena such as bleeding and swelling, and the delivery of realistic haptic and visual feedback.

Clearly, the vision of virtual surgery is still far from being achieved. This presentation introduces some of the research efforts by the Volume Graphics Research Group towards the realization of first generation virtual surgery systems. We describe our efforts in volume reconstruction, deformation of 3D models, rapid rendering, and virtual environments. We present images and animations demonstrating our recent achievements.

Finally, we discuss short term goals and long term vision for surgery simulation.

