$\boxed{4}$

11:15–11:45

FRACAS: A System for Computer-Aided Image-Guided Long Bone Fracture Surgery

Leo Joskowicz
The Hebrew University

This talk describes FRACAS, a computer-integrated orthopaedic system for assisting surgeons in closed long bone fracture reduction. FRACAS' goals are to reduce the surgeon's cumulative exposure to radiation and improve the positioning accuracy by replacing uncorrelated static fluoroscopic images with a virtual reality display of three-dimensional bone models created from preoperative CT and tracked intraoperatively in real-time. Fluoroscopic images are used to register the bone models to the intraoperative situation and to verify that the registration is maintained. This talk describes the system concept, the software prototypes of the modeling, preoperative planning, visualization, and fluoroscopic image processing modules, along with preliminary experimental results.
Joint work with Lana Tockus, Ziv Yaniv, Ariel Simkin, and Charles Milgrom.

$\boxed{5}$

11:45–12:15

Three Dimensional Freeform Sculpting via Zero Sets of Scalar Trivariate Functions

Alon Raviv
Technion — Israel Institute of Technology

This paper presents a three dimensional interactive sculpting paradigm that employs a collection of scalar uniform trivariate Bspline functions.
The sculpted object is evaluated as the zero set of the sum of the collection of the trivariate functions defined over a three dimensional working space, resulting in multi-resolution control capabilities. The continuity of the sculpted object is governed by the continuity of the trivariates. The manipulation of the objects is conducted by modifying the scalar control coefficients of the meshes of the participating trivariates. Real time visualization is achieved by incrementally computing a polygonal approximation via the *Marching Cubes* algorithm. The exploitation of trivariates in this context benefits from the different properties of the Bspline's representation such as subdivision, refinement and convex hull containment.
A system developed using the presented approach has been used in various modeling applications including reverse engineering.
Joint work with Gershon Elber.

INVITATION

ISRAEL SIGGRAPH PROFESSIONAL CHAPTER MEETING

Sponsored by

Silicon Graphics (Israel) Ltd.

8:30–12:15
December 11, 1998
Lev Hall (near Shenkar Bldg.)
Tel-Aviv University

Chair: Dani Lischinski
The Hebrew University of Jerusalem

This invitation is an entry permit for your car at gate 4 of the Tel-Aviv University campus.

8:30–9:00

Refreshments

1

9:00–9:30

Polyhedron Realization for Shape Transformation.

Avner Shapiro
Cimatron

Polyhedron realization is the transformation of a polyhedron into a convex polyhedron with an isomorphic vertex neighborhood graph. We present a novel algorithm for polyhedron realization, which is general, practical, efficient, and works for every zero–genus polyhedron. We show how the algorithm can be used for finding a correspondence for shape transformation. After the two given polyhedra are realized, it is easy to merge their *vertex–neighborhood graphs* into a common graph. This graph is then induced back onto the original polyhedra. The common vertex–neighborhood graph allows the interpolation of the corresponding vertices.
Joint work with Ayellet Tal.

2

9:30–10:00

Triangle Mesh Compression

Costa Touma
Technion - Israel Institute of Technology and **Virtue Ltd.**

The advent of the World Wide Web, and its usage for remote access to data servers through low bandwidth communication lines has dramatically increased the need for efficient compression schemes for common types of media found on the Web. For media such as audio and video, it is possible to adapt compression schemes devised for other purposes (e.g. storage) to the Internet scenario. However, the Web has introduced new data types, which are not traditional multimedia, and for which compression schemes did not previously exist. One of these is three-dimensional geometry, the main content of VRML97 files. The current VRML97 format is ASCII-based, containing a large amount of redundancy, resulting in large download times. The VRML community has realized that this is a major obstacle to real-world VRML applications and is looking towards a binary format, incorporating dedicated compression schemes for the content, e.g. 3D polygonal meshes. This is vastly superior to standard compression (e.g. using gzip) of the ASCII original.
We present a novel algorithm for the encoding of triangle mesh geometry. Mesh connectivity is encoded in a lossless manner, based on properties of planar graphs. Vertex coordinate data is quantized and then losslessly encoded using elaborate prediction schemes and entropy coding. Vertex normal data is also quantized and then losslessly encoded using prediction methods.
The compression ratios achieved by our coding algorithm are shown to be significantly better than those obtained from currently available algorithms (e.g. that of IBM), for connectivity, coordinate data and normal data. All told, the compression ratios are better by a factor of up to three with equivalent loss. Use of the algorithm may lead to significant reduction of bandwidth required for the transmission of VRML97 files over the Internet, as well as a significant reduction of storage space required for such data in any storage media.
Joint work with Chaim Gotsman.

3

10:00–10:30

Decentralized Virtual Environments

Yohai Makbili
Technion - Israel Institute of Technology

Distributed virtual environments impose a heavy load on the network upon which they reside. Bandwidth is a potential bottleneck because n users imply update messages per time unit, which is prohibitive for a large number of users. Efficient message filtering is called for, in both centralized systems, having a central server, and decentralized systems, having no central server. We solve the message filtering problem for decentralized multi-user systems based on geometric virtual worlds, popular in interactive 3D graphics applications. This is achieved by exploiting the visual relevance relationship (based on proximity, visibility and direction criteria) between pairs of users to compute mutually irrelevant regions in user parameter space. These regions are then used as update-free regions (UFR's); i.e. no communication between users is required while they are in their respective regions. Geometric algorithms for computing UFR's for the proximity, visibility and direction relevance criteria are described. Our implementation and experimental results show that the message filtering algorithm is output-sensitive. Use of our algorithms is especially effective where messages are sent through a slow communication network, such as the Internet.
Joint work with Chaim Gotsman.

10:30–11:15

Coffee Break