Chemnitz University of Technology

Computer Graphics and Visualization
Chemnitz University of Technology
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Core Competence

Virtual Reality, Virtual and Augmented Environments, User Interfaces for Virtual Environments, Geometric Modeling, Reverse Engineering, Reconstruction of Unorganised or Slice Data

Head of the Institute
Guido Brunnett

History

The group was founded in the late 80ties by some people around Prof. H. Schreiter. The focus was on traditional computer graphics, geometric modeling and CAD techniques. One important project during the early days was concerned with the development of an own C based solid modeling kernel based on boundary representation. Beginning in the 90ties the group gained first experiences with three dimensional real time graphics and 3D devices for user interaction. A lot of work was done in implementation of a PC based 3D scene editor and renderer with object animation. In 1995 the CADvis project was launched aiming at the implementation of a PC based VR-System as backend part for VR-like architectural visualization of CAD data using stereoscopic desktop VR and Head-Mounted-Display´s. The specification and implementation of a proprietary data exchange format between feature based CAD systems and VR systems was the basis

for usage of the CADvis system in cooperation with some external modellers. In 1999 Prof. Brunnett terminated his position as a professor for CAD and Computational Geometry at the University of Kaiserslautern to become the new head of the Graphics group in Chemnitz. Prof. Brunnett changed the name of the group to Computer Graphics and Visualization and defined the focal themes of the group to be Virtual Augmented Reality and Reverse Engineering. Due to the restart the group was able to invest heavily into up-to-date VR/AR equipment including a large screen projection system. For ongoing research projects see below.

Staff

1 Professor: Guido Brunnett
8 Research assistants:
Virtual Reality group: Horst Wagner, Mario Lorenz, Stephan Rusdorf, Reinhard Lober
Reverse Engineering group: Marek Vanco, Elnomery Zanaty, Miloslav Vlach, H. Maharavo Randrianarivony
1 Secretary: Rosmarie Kleindienst

Rooms and Locations

The group takes up some 350 square meters located at the main building of the University in the inner city of Chemnitz. This includes one PC based and one workstation based lab for generative computer graphics and one special lab for Virtual and Augmented Reality, the visualization center. All the labs are located in direct neighbourhood to the multimedia lab operated by the Department of Computer Science.

Financing

Computer Graphics an Visualization is a professorship of the Chemnitz University of Technology. Because of that, the main part of the infrastructure and four staff members are financed by the university. All other staff members and parts of the equipment are funded by external sources such as DFG, HBFG, SMWA Saxony and AIF.

Current Structure and Important Partners

The Computer Graphics and Visualization professorship is subdivided in the Reverse Engineering and the Virtual Reality group. There is a comprehensive cooperation between these groups. One common research area is the combination of Reverse Engineering and Virtual Reality technology in high level modeling of virtual scenes. Additionally, both groups cooperate closely with the Multimedia group at the Chemnitz University of Technology, with the Institute of Anatomy of the University of Göttingen and with the Computer Graphics group at the University of Ilmenau.

Current Research

In the context of a Reverse Engineering (R.E.) project the group is concerned with all aspects of the R.E. process that includes data reduction, smoothing, structuring of unorganized point data, segmentation and surface fitting. The most successful approach so far developed by Vanco and Brunnett avoids the computation of a triangulation of the point set. Instead segmentation and surface fitting are based on surface properties that are estimated from the neighbourhood graph of the point set. This method is refered to as "direct segmentation". In cooperation with the Institute of Anatomy of the University of Göttingen a visualization system for medical slice data is developed. The slice data is digitized using the "Huge Image System" of Fa. Zeiss / University of Göttingen that is capable of creating very high resolution photos of object segments and integrating them into one image. In this context our group is concerned with the extraction of contour data, the 3D reconstruction of the sliced object and the interactive visualization. Current research in Virtual Reality is focussed on the issues of high-level modeling of virtual scenes, user interaction with virtual objects and multi-projection rendering for curved screens or caves. The result of the CAAD/VRT-project, the CADvis system, is in process to be expanded with an animation subsystem. The VR group is working on efficient, multivalent algorithms for description and manipulation of animated 3D objects. The animation module communicates with the rendering part using a special description language. The complete CADvis system is to pass through a upgrade and reengineering phase to support UNIX based clustered environments for rendering and interaction in multi-segmented projection devices. Additionally, a algorithm is in work to reduce the complexity of a modelled scene. This method uses a massive parallel UNIX cluster to distribute the computation of simplified geometric representations for scene parts. The simplification is based on the substitution of geometry by real time computed texture maps. Another research area is AR supported modeling of design lines on surfaces. The goal is the development of a software prototype giving the possibility to designers to draw virtual design lines onto a real surface using AR helmet or glasses and electro magnetic tracking system. The software has to deal with the problem to interlink a virtual object to a real body, to track any movements of the real object with very high precision and to guarantee congruence always. The design lines are generated using special input and manipulation functionality based on a tracked pencil. The main difficulty is to compute curves from the tracked data. The resulting curves, or first pointed lines, are rendered to the AR device.

Important Recent Project Participations

- „SMWA": Entwicklung einer CAAD/VRT-Lösung zur Entwurfsplanung:
- „DFG-SPP": „Effiziente Algorithmen für diskrete Probleme und ihre Anwendungen"
- „DFG-SFB 393" Numerische Simulation auf massiv parallelen Rechnern: „DFG": „Automatische Rekonstruktion von Oberflächen und Volumina aus Punktdaten"
- Stiftung Innovation für Rheinland-Pfalz: „Optimierung von Werkzeugverfahrwegen durch nichtlineare Modellierung"

Important Recent Industrial Partners

CADSYS GmbH Chemnitz, AIC GmbH Chemnitz IPK Fraunhofer Institut Berlin, PFI Prüf- und Forschungsinstitut Pirmasens e.V., IMK Engineering Frankenberg

Future of the Lab

The Computer Graphics and Visualization group will continue their activities on the described research areas and start new projects in the area of modeling virtual humans. For the next years we intend to integrate existing cooperations with the local industry into an initative to found a regional Competence Center for Virtual Reality.