

University of Girona

Girona Graphics Group (GGG)
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Core Competence

Global Illumination, Realistic Rendering, Scientific Visualization, Computational Geometry, Information Theory in Computer Graphics, Stochastic Techniques, Perception, Applications



Head of the Institute
Xavier Pueyo

History

The computer graphics research activities started at the Universitat de Girona in 1992. Since then the group has worked mainly in realistic image synthesis enlarging its scope in the last years to scientific visualization, complexity and computational geometry. Recently other topics, perception and appearance, have been included to the interest of the group. Members of the GGG are involved in teaching activities for undergraduate and graduate students. The GGG has organised several national computer graphics as well as the Eurographics Workshop on Parallel Graphics and Visualization 2000. The GGG belongs to the Centre of Reference of Advanced Technologies of the Catalan Ministry of Universities and Research.

Staff

2 *Professors*: Xavier Pueyo, László Neumann



3 *Associate professors*: Jordi Regincos, Mateu Sbert, Toni Sellares

3 *Researchers*: Gonzalo Besuievsky, Imma Boada, Ignacio Martin

9 *PhD students*: Carles Bosch, Francesc Castro, Miquel Feixas, Roel, Martinez, Alex Mendez, Gustavo Patow, Frederic Perez, Jaume, Rigau, Pere-Pau Vazquez

1 *Technician*: Joan Surrell

Rooms and Locations

The group occupies some 300 square meters and is located in the 1st floor of the computer science building (P4). This includes special lab for virtual reality and computer games.

Financing

Most of the staff and basic infrastructure are financed by the Spanish government as a group of the Universitat de Girona (UdG). One senior, permanent, researcher is financed by ICREA (Institutio Catalana de Recerca i Estudis Avancats) and some PhD scholarship are granted by the Spanish and the Catalan governments, and the by UdG. Most of the research equipment and some research assistants are paid from projects funded by the Spanish and the Catalan governments, and the EU.

Current Structure and Important Partners

The GGG is a group of the Institut d'Informàtica i Aplicacions. The other groups work on computer vision, robotics, communications and control. The GGG is organized



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in several work areas: global illumination (G.Besuievsky, I.Martin, X.Pueyo), Stochastic techniques and information theory (M.Sbert), Computational Geometry (A.Sellares), scientific visualisation (I.Boada, L.Neumann, J.Regincos, M.Sbert), Perception and appearance (L.Neumann).



Current Research

The GGG keeps on working in problems derived from the need of simulating light transport better and/or faster. This involves to try to accelerated global illumination mechanisms by means of proposing new algorithms and/or using specialised hardware. Finite element approaches and stochastic techniques (Monte Carlo and Quasi Monte Carlo) as well as hibrid ones are used for environments with general reflectance ans transmittance functions. Algorithms are also developed for dynamic environments with moving actors, sources and cameras. We study the application of information theory key concepts such as entropy and mutual information to Computer Graphics. We have used it in efficients supersampling schemes for ray tracing, discretisation algorithms for hierarchical radiosity and good view points computation. Our work in computational geometry includes research on quality projections, subdivisions reconstruction and Voronoi diagrams approximations. In the first topic we consider the problem of computing nice and non-degenerate orthogonal and perspective projections in space. The second deals with the reconstruction from random section and the rear with hierarchical Voronoi diagrams representations. The work of GGG in visualization has concentrated, up to now, mainly in medical applications; but other results have also been obtained like the computatiion of good views in molecular visualization. In medical imaging we have focused on the development of a hybrid technique combining the direct volume rendering approach with surface rendering techniques. We also deal with the design of data structures able to support multiresolution and adaptive techniques. The GGG has projected part of his research into specific fields.

In addition to those already mentioned these applications are:- Architecture and urbanistic design.
 - Reflectors design: direct and invers.
 - Simulation of environments for the design and training of vision systems.
 - Videogames.
 - Simulators for safety applications.

Important Recent Project Participations

- CAD for driving simulators based on lighting simulation.
- MCYT-TIC2001-02392-C03-01. 2001-2004. Photorealistic image synthesis in computer games.
- MCYT-TIC2001-02416-C03-01. 2001-2004. Immersive interaction systems for Virtual Environments.
- MCYT-TIC2001-02226-C02-02. 2001-2004. Virtual prototypes for architecture and industrial buildings.
- DURSI-CeRTAP. 2002-2005 Realistic simulation of light for general environments. SIMULGEN.
- Esprit Open LTR 25772 and 35772. 1st phase 1997-1998. 2nd phase 1999-2002.

Important Recent Industrial Partners

KINORA, ERCO Iluminacion, Saber Interactive, Hospital Josep Trueta.



Future of the Lab

The GGG will continue his basic research in the fundamental areas mentioned above which are the conducting axes of the group activities. These will be increased by the inclusion of a new work area: perception and appearance. Our work in the coming years will also be influenced by the introduction of virtual reality devices in the application we are dealing with as well as by the use of internet for developing cooperative applications. The future research of GGG will also develop towards the improvement of the application of our results to the fields stated above.