Institute of Computer Graphics and Knowledge Visualisation, Graz University of Technology

Applications are invited for a 3 year PhD position

The Institute for Computer Graphics and Knowledge Visualization at Graz University of Technology (TU Graz), Austria participates since 2012 in a joint PhD programme with the School of Computer Science and Engineering at Nanyang Technological University (NTU), Singapore.
Currently, we offer a 3 year **PhD Position** on this joint program at the Institute for Computer Graphics and Knowledge Visualisation, with a focus on research in Geometric Modeling, 3D Computer Graphics and Novel Applications in Visual Computing. The PhD includes a one year stay at NTU in Singapore in the second year, while year one and three will be spend at TU Graz, Austria. The PhD will be dual degree, that is the degree will be both, from TU Graz and NTU.

The application deadline is: **March 1st, 2018**.

Topic

Computer-aided design (CAD) is the use of computer systems to aid in the creation, modification, anal- ysis, or optimization of a design. Most CAD software is traditionally based on NURBS spline surfaces. In recent years subdivision surfaces are becoming increasingly important for the development of high quality surfaces involved in CAD. Since the first time they were used in Pixars movie Geris game, they had great success in the entertainment industry and they are now widely supported in nearly all modern modeling programs for graphic applications. Their flexibility and the fact that some subdivision surfaces represent a superset of the standard Non-Uniform Rational B-Spline (NURBS) representation (see, e.g., [7, 4]) easily suggests that they can be the future description form of all geometric data.

A subdivision surface is a method of representing a smooth surface via a specification of a coarser piecewise linear polygon mesh, the control mesh. A subdivision scheme is an iterative refinement which generates a sequence of finer and finer nets which converge to a smooth surface. Despite its simple iterative approach, the analysis of subdivision surfaces is hard and it has taken the last 40 years to understand exactly what characteristics a subdivision surface has in the limit. We now know that most reasonable schemes will have continuous tangent plane everywhere, and that it is possible to choose the coefficients so that the curvature remains bounded, though not quite constant in any region around irregular points [3, 2, 1].

The successful applicant will be working on aspects of geometry processing in order to improve the usability of subdivision surfaces.

Description of the project:

We are looking into improving the creation of subdivision control meshes from point clouds to apply subdivision surfaces in CAD and analysis.

The evolution of 3D scanning devices and innovation in computer processing power and storage capacity has sparked a revolution in producing big point-cloud datasets. The big point-cloud datasets have caused complexity in handling surface reconstruction and visualization since existing algorithms are not readily available. In this project we aim to solve problems involving big point-cloud datasets from 3D scanning devices by converting the data to a mathematical representation, namely subdivision surfaces. This research can take a range of directions. One path we like to explore is applying deep learning to obtain good control meshes. What defines a ”good” control mesh depends on the context in which the mesh will be used. We are investigating ways in which surface geometry for design and analysis can be modelled in the same framework based on subdivision surfaces [5, 6].

The research has multidisciplinary aspects drawing from computer science, mathematics, engineering and physics.

Requirements:

We are seeking an excellent and highly motivated PhD student interested in the fields of Computer Graphics, Geometry Processing, Computer Aided Design (CAD), Simulation and Analysis.

A master degree in applied/computational mathematics or a closely related field is required with excellent grades. The applicant ideally has a good understanding of geometric modelling and processing, and/or finite element methods. Due to the computational nature of the project, programming skills (in Fortran/C++/Matlab) are also required. Additionally, some background in mesh processing (and/or computer aided geometry design) will be highly desirable.

The selected candidates are expected to join by 1st of April 2018 or as soon as possible thereafter.

Opportunities:

What we offer in exchange:

- A creative environment in Graz, one of the most beautiful and lively cities in Austria.
- A young and international team of researchers with an excellent working atmosphere.
- A work environment that is equipped with the newest hardware and software technology.
- The possibility to present your research results at international top conferences.

Entry level salary as a PhD researcher is currently 2.731,55 Euro gross, which is paid 14x per annum. As a PhD researcher at TU Graz you are also entitled to full social benefits.

Freedom to explore your scientific interests in the course of your work (within the scope of the project goals).

- Continuing personal and professional education.

The position includes one year stay at Nanyang Technological University (NTU), where you will continue your work under excellent local supervision. NTU is an autonomous institution

based in Singapore. It has been ranked the best university in the world under fifty years of age, according to QS Top 50 Under 50 2016-2017 and is also 11th in the world in the QS World University Rankings 2018 and third in the QS University Rankings: Asia 2016.

- You will receive a dual degree from TU Graz and NTU Singapore.

Contact:

To apply send all necessary documents to

Institute of Computer Graphics and Knowledge Visualization Department of Information Technology

Graz University of Technology Ass. Prof. Ursula H. Augsdorfer

Inffeldgasse 16c

A-8010 Graz

Please mail *u.augsdorfer@cgv.tugraz.at* for further details.

References

[1] U. H. Augsdo¨ rfer, N. A. Dodgson, and M. A. Sabin. Removing polar rendering artifacts in subdivision surfaces.

Journal of Graphics, GPU, and Game Tools, 14, 2009.

[2] U.H. Augsdo¨ rfer, T.J. Cashman, N.A. Dodgson, and M.A. Sabin. Numerical checking of C_1 for arbitrary degree subdivision schemes. In *Proceedings of the 13th IMA International Conference on Maths of Surfaces XIII*, pages 45–54, 2009.

[3] U.H. Augsdo¨ rfer, N.A. Dodgson, and M.A. Sabin. Tuning subdivision by minimising gaussian curvature variation near extraordinary vertices. *Computer Graphics Forum*, 25(3):263–272, 2006.

[4] T.J. Cashman, U.H. Augsdo¨ rfer, N.A. Dodgson, and M.A. Sabin. NURBS with Extraordinary Points: High-degree, Non-uniform, Rational Subdivision Schemes. *ACM Transactions on Graphics*, 28(3), 2009.

[5] A. Riffnaller-Schiefer, U. Augsdo¨ rfer, and D. Fellner. Isogeometric analysis for modelling and design. *EG short Paper*, 2015.

[6] A. Riffnaller-Schiefer, U. Augsdo¨ rfer, and D. Fellner. Isogeometric shell analysis with nurbs compatible subdivision surfaces. *Applied Mathematics and Computation*, 272:139–147, 2016.

[7] T.Sederberg, D.Sewell, and M.Sabin. Non-uniform recursive subdivision surfaces. In *Proceedings of SIGGRAPH 1998*, pages 387–394, 1998.

Members@eg.org
https://europa.cgv.tugraz.at/mailman/listinfo/members