



Tutorial: Geometric Modeling Based on Polygonal Meshes

Date: Tuesday, April 15th

Time: 09:00 – 12:30 & 14:00 - 17:30 (**Full-day Tutorial**)

Presenters:

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Abstract: Polygonal meshes are nowadays intensively used in many different areas of computer graphics and geometry processing. In classical CAGD polygonal meshes developed into a valuable alternative to traditional spline surfaces, since their conceptual simplicity allows for more flexible and more efficient processing. Moreover, the consequent use of triangle meshes avoids error-prone conversions, e.g., the meshing of CAD surfaces for numerical simulations. Besides classical geometric modeling, other major areas frequently employing triangle meshes are computer games and movie production. In this context geometric models are often acquired by 3D scanning techniques and have to undergo post-processing and shape optimization before being actually used in production.

The course starts with a comparison of different surface representations, motivating the use of polygonal meshes. We discuss the removal of geometric and topological degeneracies, and introduce quality measures for polygonal meshes, followed by their respective optimization, namely smoothing, decimation, and remeshing. We further discuss parametrization and present interactive shape editing, including a brief discussion on efficient numerical solvers. Since the course covers the whole mesh processing pipeline, it can give a full overview and point out interesting and important connections between the individual topics.

For each topic we present the fundamental concepts and current state-of-the-art techniques. Frequent software demonstrations will give the participants a better understanding of the discussed algorithms. Moreover, these demo applications will be available from the course materials, both as binaries and in full source code, based on the popular mesh libraries OpenMesh and CGAL. This enables the participants to implement the discussed algorithms and reproduce the results published in the corresponding papers.



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Mario Botsch is a post-doctoral lecturer and senior researcher at the Computer Graphics Laboratory of ETH Zurich, Switzerland. He received his MS in Mathematics from the University of Erlangen-Nuremberg, Germany, in 1999. From 1999 to 2000 he worked as research associate at the Max-Planck Institute for Computer Science in Saarbrücken, Germany. From 2001 to 2005 he worked as research associate and PhD candidate with Prof. Dr. Leif Kobbelt at the RWTH Aachen, Germany, from where he received his PhD in 2005. He is an experienced speaker and presented papers and courses at SIGGRAPH and EUROGRAPHICS. Dr. Botsch has served on various program committees including EUROGRAPHICS and the Symposium on Geometry Processing, and has co-chaired the Symposium on Point-Based Graphics in 2006 and 2007. Recently, he received the EUROGRAPHICS 2007 young researcher award for his contributions to computer graphics and geometry processing. Dr. Botsch's research interests include geometry processing in general, and mesh generation, mesh optimization, and shape editing in particular.

Mark Pauly is an assistant professor at the computer science department of ETH Zurich, Switzerland. From August 2003 to March 2005 he was a postdoctoral scholar at Stanford University, where he also held a position as visiting assistant professor during the summer of 2005. He received his Ph.D. degree in 2003 from ETH Zurich and his M.S. degree in computer science in 1999 from the Technical University of Kaiserslautern, Germany. Dr. Pauly has served on various program committees including ACM SIGGRAPH, EUROGRAPHICS, and the Symposium on Geometry Processing, and has co-chaired the Symposium on Point-Based Graphics. He is an experienced speaker and has previously presented courses at SIGGRAPH and EUROGRAPHICS. Dr. Pauly was awarded the EUROGRAPHICS 2006 young researcher award for his contributions to computer graphics and geometry processing. His research interests include geometry processing, multi-scale shape modeling and analysis, physics-based animation, and computational geometry.

Leif Kobbelt is a full Professor of Computer Science and the Head of the Computer Graphics group at the RWTH Aachen University of Technology, Germany. His research interests include all areas of Computer Graphics and Geometry Processing with a focus on multiresolution and freeform modeling, 3D model optimization, as well as the efficient handling of polygonal mesh data. He was a senior researcher at the Max-Planck Institute for Computer Science in Saarbrücken, Germany, from 1999 to 2000 after he received his Habilitation degree from the University of Erlangen, where he worked from 1996 to 1999. In 1995/96 he spent a post-doc year at the University of Wisconsin, Madison. He received his PhD and MS degrees from the University of Karlsruhe, Germany, in 1994 and 1992, respectively. Dr. Kobbelt's research work during the last years resulted in numerous publications in top scientific journals and international conferences. He is invited regularly to give keynote presentations and tutorial lectures. For his contributions he received several scientific awards. He has ongoing collaborations with colleagues in Europe, North America, and Asia, and frequently serves on international program committees. He organized and co-chaired several workshops and conferences.

Pierre Alliez is a researcher at the GEOMETRICA project-team of INRIA Sophia-Antipolis, France. He studied Image Processing, Computer Vision, Computer Graphics and Computational Geometry at the University of Nice Sophia-Antipolis, France, where he received his MS degree in 1997. He was awarded a Ph.D. in Image and Signal Processing in 2000 from the 'Ecole Nationale Supérieure des Télécommunications, Paris. He then spent a year as a post-doctoral researcher at the University of Southern California. Dr. Alliez has served on various program committees including EUROGRAPHICS, SIGGRAPH and the Symposium on Geometry Processing, and is co-chairing the Symposium on Geometry Processing 2008. He was awarded in 2005 the EUROGRAPHICS young researcher award for his contributions to computer graphics and geometry processing. Dr. Alliez is an active contributor of the Computational Geometry Algorithms Library (CGAL). His current research interests include surface reconstruction, mesh generation and surface remeshing.

Bruno Levy is a researcher with INRIA. He is the head of the ALICE research group. He did a Ph.D. (1996-1999) with J.-L. Mallet, on 3D modeling for oil exploration, in the INPL (Nancy, France). His Ph.D. thesis was awarded the SPECIF price in 2000 (best French Ph.D. thesis in Computer Sciences). He then did a post-doc in Stanford university,



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in the SCCM group (headed by G. Golub) where he learnt numerical optimization, and in the earth sciences group (headed by A. Journel and K. Aziz) where he learnt finite element modeling. He has served on various program committees, including Eurographics, Visualization and the Symposium on Geometry Processing. He was program co-chair of the ACM Symposium on Solid and Physical Modeling in 2007 and 2008. His main contributions concern texture mapping and parameterization methods for triangulated surfaces, that are now used by several popular 3D modeling software (including Maya, Catia, Silo, Blender and Gocad).