Module MA-INF 2209	**Advanced Topics in Computer Graphics I**
Workload 270 h	**Credit points** 9 CP | **Duration** 1 semester | **Frequency** every year
Module coordinator	Prof. Dr. Reinhard Klein
Lecturer(s)	Prof. Dr. Reinhard Klein
Classification	**Programme** M. Sc. Computer Science | **Mode** Optional | **Semester** 2. or 3.
Technical skills	Analytical formulation of problems related to geometry processing and rendering. Knowledge of techniques and algorithms to optimize, process, analyze and store geometry and reflectance data as well as knowledge of the major algorithms for the simulation of light distributions in 3D-scences and volume data sets. Self-dependent implementation of the basic algorithms.
Soft skills	Based on the knowledge and skills acquired students should be able to • read and judge current scientific literature in the area of geometry processing and rendering • identify the major literature concerning a given problem in geometry processing or rendering and gain an overview of the current state of the art • discuss problems concerning geometry processing or rendering with researchers from different application fields • present and propose different solutions and work in a team to solve a mesh processing or rendering problem • and should have acquired key-competences like motivation to deliver results, flexibility, scientific integrity, ability to adapt to changes and ability to communicate
Contents	Topics among other will be: • methods for the generation of polygonal meshes from point clouds • efficient mesh data structures and mesh compression • mesh optimization techniques: denoising, smoothing, decimation, refinement • mesh editing techniques • optical material properties and light sources • light transport and rendering equation • algorithms and techniques for the solution of the rendering equation • advanced methods for photorealistic image generation. In addition, results from state of the art research will be presented.
Prerequisites	**Required:** Basic knowledge in computer graphics, data structures, multidimensional analysis und linear algebra, numerical analysis and numerical linear algebra, C++
Format	**Teaching format** | **Group size** | **h/week** | **Workload[h]** | **CP** Lecture | 60 | 4 | 60 T / 105 S | 5.5 Exercises | 30 | 2 | 30 T / 75 S | 3.5 T = face-to-face teaching; S = independent study
Exam achievements	Oral presentation, written report (graded)
Study achievements	Successful exercise participation (not graded)
Forms of media	
Literature	• M. Botsch, L. Kobbelt, M. Pauly, P. Alliez, B. Levy, Polygon Mesh Processing, A K Peters (7. Oktober 2010) • M. Gross, HP. Pfister, Point-Based Graphics, Morgan Kaufmann (21. Juni 2007) • R. Scopigno, C. Andujar, M. Goesele, H. Lensch: 3D Data Acquistion, Eurographics Tutorial, 2002 • E. Grinspun, M. Desbrun (organizers): Discrete Differential Geometry: An Applied Introduction, Siggraph Course Notes, 2006 • L. Szirmay-Kalos: Monte-Carlo Methods in Global Illumination, Institute of Computer Graphics, Vienna University of Technology, Vienna. URL: citeseer.ist.psu.edu/szirmay-kalos00montecarlo.html, 1999/ • P. Dutre, K. Bala, P. Bekaert: Advanced Global Illumination, 2nd ed., B&T, 2006 • M. Pharr, G. Humphreys: Physically Based Rendering, Elsevier, 2nd revised edition. (26. August 2010)