CMPT 764 - G100 Geometric Modelling in Computer Graphics

Instructor(s): Richard Zhang

Calendar Objective/Description:
Advanced topics in geometric modelling and processing for computer graphics, such as Bezier and B-spline techniques, subdivision curves and surfaces, solid modelling, implicit representation, surface reconstruction, multi-resolution modelling, digital geometry processing (e.g., mesh smoothing, compression, and parameterization), point-based representation, and procedural modelling.

Instructor's Objectives:
This course covers recent and advanced modeling techniques in computer graphics. Our focus will be on the acquisition, representation, processing and synthesis of 3D shapes, with applications to games development, computer aided design and 3D fabrication.

The main modeling primitive studied will be polygonal meshes, which have been the dominant surface representation for highly detailed free-form 3D data. In recent years, mesh modeling and processing has been the most intensely studied subject in geometric modeling. This field is still fast evolving with many interesting problems and much aspiration for application development and future research. EG: in deep learning, computational design and fabrication.

Basic mathematical concepts and tools necessary to understand the course will be presented depending on students' background. But the ability to program in C/C++ with OpenGL is required.

This course will be cross-listed with CMPT 464

Prerequisites:
CMPT 361, MACM 316. Students with credit for CMPT 464 or equivalent may not take CMPT 764 for further credit.

Topics:
- Introduction to various surface representations and modelling paradigms; tensor-product surfaces,
- implicit surfaces, polygonal meshes, subdivision surfaces and point-sampled geometry
- Subdivision surfaces and modelling
- 3D shape acquisition and surface reconstruction
- Level of details and multi-resolution modelling
- Digital geometry processing; smoothing, feature extraction, segmentation and correspondence
- Machine learning in shape analysis and geometric modelling
- 3D Printing

Grading:
Two (2) midterms (35%), two (2) homework assignments (30%) and a final project (35%)

Recommended Books:
Level of Detail for 3D Graphics - No longer in print - available online for free - see link, D. Luebke, et al, Morgan Kaufman, 2003, 9781558608382, http://www.google.ca/url?sa=t&usg=odvEqjAc=http%3A%2F%2Fge0.googlecode.com%2Ffiles%2FLevel%2520of%2520Detail%2520for%25203D%2520Graphics.pdf=9-NKVIi3CYmcyQTQt4C4BQ=AFQjCNEDyGsSRr86TGa6eLezndXM0MPmRg=bv.77880786,d.aWw

Reference Books:
Polygonal Mesh Processing, Mario Botsch, Leif Kobbelt, Mark Pauly, Pierre Alliez and Bruno Levy, AK Peters, 2010, 9781568814261

Practical Algorithms for Image Analysis: Description, Examples Code, M. Seul, L.O'Gorman, M.J. Sammon, Cambridge University Press, 2000, 9780521660655, No longer in print - will not be available in Bookstore - please search online for new/used copies


Survey papers on selected topics,

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