CSE 530: GEOMETRIC FOUNDATIONS FOR GRAPHICS AND VISUALIZATION

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Important Information

- WHEN: TuTh 9:50am 11:10am
- WHERE: currently at Light Engineering Lab 152 (it possible that we will move our lecture back to our Computer Science Seminar Room (Rm.1306) after the first lecture)
- OFFICE HOURS: TuTh 12:40pm 2:10pm, or by appointment!
- CREDITS: 3
- HOW CAN I GET an "A"?
 - NO midterm tests!
 - NO final exams!
 - ASSIGNMENTS and PROJECT only!!!

Course Synopsis

Our goals —

- Geometric concepts
- Mathematical tools
- Geometric modeling techniques
- Fundamental algorithms
- Graphics and visualization relevance
- Technical coverage
 - polygonal and curved objects
 - parametric and implicit representations
 - modeling of curves, surfaces, and solids
 - spline theory
 - wavelet theory
 - multi-resolution synthesis and analysis
 - differential geometry
 - more advanced topics

Course Facts

- This is a graduate course!
- Can I take this course? YES, if YOU
 - are a graduate student with CS background
 - have skills in calculus and linear algebra
 - have BASIC knowledge on graphics and visualization
 - or, talk to the instructor
- You do NOT need to take CSE528 prior to this course
- However, you need to have taken CSE328, or CSE332, or equivalent courses elsewhere
- No required textbooks
- Several suggested references
- Lecture notes are important!

• Class attendance is critical!

Course Facts

- Students are expected to
 - finish four course assignments
 - complete one course project
 - present your project in the class
 - submit the final report
- What projects are appropriate?
 - talk to the instructor
 - projects available from the instructor

Course Facts

- NOT a graphics/visualization course
- NOT a course to teach OpenGL
- Do NOT teach graphics (basic knowledge & programming skills should be acquired elsewhere)
- Study geometric fundamentals and applications!
- Learn geometric modeling and its significance for visual computing applications
- Course projects lead to MS thesis (project) or Ph.D dissertation topics

Assignments and Projects

- Programming assignments: 30%
- Course project: 70%
- Basic project requirements
 - interactive interface (graphics-based)
 - intuitive and easy to understand
 - efficient (fast, high-performance)
 - basis functionalities
 - examples
 - flexible and easy to generalize
- Project plan (multiple check-points and phases)
 - study a set of relevant papers (throughout the semester)
 - submit your own proposal (1 1.5 month)
 - implement basic functionalities and user interface (2 2.5 month)
 - class presentation & final demo (3 3.5 month)

- final report (3.5 month)
- Individual project only (no group project)
- Office hours / individual meetings
- Penalty for late submission

What will be covered



<u>Outline</u>

- Mathematical tools and fundamental algorithms
- geometric modeling concepts and techniques
- parametric and implicit theory
- subdivision and multi-resolution
- differential geometry concepts
- graphics, visualization, and other visual computing applications
- advanced topics

References

- Curves and Surfaces for Computer Aided Geometric Design: A Practical Guide Fourth Edition, Gerald Farin, September 1996
- Geometric Modeling, Second Edition, Michael E. Mortenson, John Wiley & Sons, January 1997
- The NURBS book, Second Edition, Les A. Piegl and W. Tiller, Springer Verlag, January 1997

Other Books

- Computer Graphics,
 Hearn and Baker, 2nd edition,
 Prentice Hall, 1997.
- Computer Graphics: Principles and Practice,
 James D. Foley, Andries van Dam, Steven K. Feiner,
 and John F. Hughes, 2nd edition,
 Addison Wesley, 1990.
- An Introduction to Splines for use in Computer Graphics a Geometric Modeling,
 R.H. Bartels, J.C. Beatty, and B.A. Barsky, Morgan Kaufmann Publishers, Inc., 1987.
- Computational Geometry for Design and Manufacture,
 I.D. Faux and M.J. Pratt,
 Ellis Horwood, Chichester, England, 1979.
- Geometric and Solid Modeling: An Introduction, C.M. Hoffmann,

Morgan Kaufmann Publishers, Inc., San Mateo, CA, 1989.

- Differential Geometry of Curves and Surfaces, M.P. do Carmo, Prentice–Hall, Englewood Cliffs, NJ, 1976.
- Introduction to Applied Mathematics,
 G. Strang, Wellesley Cambridge Press, 1986.
- Numerical Recipes: The Art of Scientific Computing,
 W.H. Press, B.P. Flannery, S.A. Teukolsky, and
 W.T. Vetterling, Cambridge University Press,
 Cambridge, UK, 1986.

Journals and Conferences

- Computer Graphics (Proceedings of ACM SIGGRAPH)
- ACM Transactions on Graphics
- IEEE Transactions on Visualization and Computer Graphic
- IEEE Computer Graphics and Applications
- Computer-Aided Design
- Computer Aided Geometric Design
- Others!