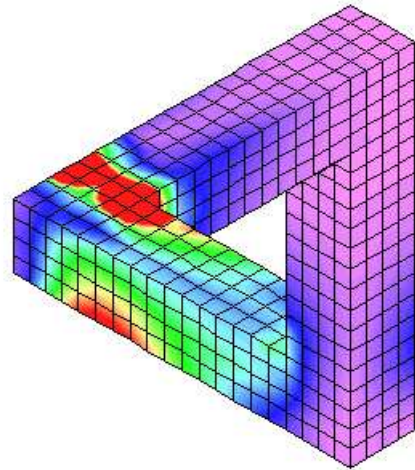# COT5520: COMPUTATIONAL GEOMETRY
SYLLABUS

"Geometry is the science of correct reasoning on incorrect figures."
George Polya (1887 to 1985)

BASIC INFO

- **Course number:** COT5520

- **Semester:** Fall 2006

- **Schedule:** Tue 3:00-4:55pm
  Thu 4:05-4:55pm

- **Location:** MCCA2196

- **Credit hours:** 3

- **Professor:** Alper Üngör
  CSE 430
  ungor@cise.ufl.edu
  http://www.cise.ufl.edu/~ungor

- **TA:** Tianyun Ni
  CSE 309
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- **Office hours:** Wed 10am-noon (Alper)
  Thu 10am-noon (Tianyun)

- **Web-page:** http://www.cise.ufl.edu/~ungor/courses/fall06

MAIN THEME

Computational geometry is the field of theoretical computer science devoted to design, analysis, and implementation of algorithms and data structures to solve geometric problems. It has numeruous application domains including computer graphics, visualization, robotics, computational biology, data mining, parallel computing, and scientific computing. This course will survey the fundamental concepts in geometric algorithms and data structures. Topics that will be covered include:

Convex hulls	*Plane-sweep algorithms*
Triangulations	*Geometric data structures*
Range searching	*Point location*
Voronoi diagrams	*Delaunay triangulations*
Randomized algorithms	*Arrangements*
Nearest neighbors	*Surface simplification*
Morse theory	*Robot motion planning*
Protein modeling	*Visibility graphs*

Grades will be based on homeworks (30%), a semester project (40%), a final exam (30%).

- **Homework:** There will be 4-5 homework assignments, each consisting of 4-6 problems.

- **Project:** It could be a survey paper, a programming project, or a research on an open problem. A one-page project proposal should be submitted by mid-semester. Final project reports are due to the second last week of the semester.

- **Exam:** There is no mid-term exam but one final exam. It will be on the last day of classes, Dec 5 2006, Tuesday.

- **Attendance:** Class participation is strongly encouraged as bonus points will be awarded.

- **Textbook:** *Computational Geometry: Algorithms and Applications.* Mark de Berg, Marc van Kreveld, Mark Overmars, and Otfried Schwarzkopf, (Springer-Verlag, 2nd edition, 2000).

- **Other recommended books:**

  1. *Algorithms in Combinatorial Geometry.* H. Edelsbrunner, (Springer-Verlag, 1987).
  2. *Geometry and Topology for Mesh Generation.* H. Edelsbrunner, (Cambridge Univ. Press, 2001).
  3. *Computational Geometry: An Introduction Through Randomized Algorithms.* K. Mulmuley, (Prentice-Hall, 1994).
  4. *Computational Geometry: An Introduction.* F. Preparata and M. Shamos, (Springer-Verlag, 1985).
  5. *Computational Geometry in C.* J. O'Rourke, (Cambridge Univ. Press, 1994).
  6. *Introduction to Algorithms (2nd ed).* T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, (MIT Press and McGraw-Hill, 2001).

- **Conferences:** SoCG, CCCG, JCDCG, WCG, SODA, STOC, ISAAC, LATIN, ...

- **Journals:**

  1. *CGTA: Computational Geometry: Theory and Applications*
  2. *DCG: Discrete & Computational Geometry*
  3. *IJCGA: Int. Journal of Computational Geometry and Applications*

- Also watch the class web page for other survey and research papers, links, etc.

Tentative Timeline

Date	Lecture Topic	Assignments
Aug 24 Th	Syllabus, course structure, introduction, project ideas	HW#0 out
Aug 29 Tu	Convex Hulls	
Aug 31 Th	More on convex hulls	HW#0 due
Sep 5 Tu	Line segment intersections	
Sep 7 Th	Doubly-Connected Edge List	HW#1 out
Sep 12 Th	Subdivision Overlays	
Sep 14 Tu	Art Gallery Problems	
Sep 19 Tu	Polygon Triangulation	HW#1 due
Sep 21 Th	Convex Partitioning	
Sep 26 Tu	Linear Programming	
Sep 28 Th	Range Searching	HW#2 out
Oct 3 Tu	Fractional Cascading	
Oct 5 Th	Inverse Range Searching	
Oct 10 Tu	Voronoi Diagrams	HW#2 due
Oct 12 Th	Delaunay Triangulations; Edge Flip Algorithm	
Oct 17 Tu	Randomized incremental algorithm	Proposals due
Oct 19 Th	Point Location	HW#3 out
Oct 24 Tu	Delaunay Refinement	
Oct 26 Th	Project Discussion	
Oct 31 Tu	Surface reconstruction and simplification	HW#3 due
Nov 2 Th	Topology and Geometry	
Nov 7 Tu	Zones	
Nov 9 Th	Levels and discrepancy	HW#4 out
Nov 14 Tu	Topological sweep	
Nov 16 Th	Robot motion planning	
Nov 21 Tu	Visibility graphs	HW#4 due
Nov 23 Th	*THANKSGIVING BREAK*	
Nov 28 Tu	Project Presentations	
Nov 30 Th	Project Presentations	Projects due
Dec 5 Tu	Final-exam	

- **Announcements:** Students are responsible following the announcements on the course web-page (http://www.cise.ufl.edu/~ungor/courses/fall06). Schedule updates regarding the homeworks, exams and office hours will appear on the web-page.

- **Accommodations for Students with Disabilities:** Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

- **The University's Honesty Policy:** All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.
  The following links contain additional information relating to academic honesty:
  - http://lss.at.ufl.edu/services/turnitin/resources.html
  - http://www.dso.ufl.edu/judicial