Instructor: Prof. Sara McMains  
5145 Etcheverry Hall, (510) 852-9359  
Office Hours: Th 4-5, W 11:15-noon  
If you email, please include your phone number.

Lectures:  
TuTh 2-3:30  3105 Etcheverry

Catalog Description:

Graduate survey of solid modeling research. Representations and algorithms for 3D solid geometry. Applications in design, analysis, planning, and manufacturing of mechanical parts, including CAD/CAM, reverse engineering, robotics, mold-making, and rapid prototyping.

Requirements:

- Read assigned papers and turn in 4 bullet points, <= 1 sentence each, in your own words, of main contributions & limitations at the start of lecture.
- 2 midterm quizzes, closed book, on the reading & lecture material (in-class, tentatively scheduled for October 11 & December 1)
- 7 homework assignments. The final one will likely include CNC machining, which is likely to occur during RRR or exam week.

Grading:

- 45% Homework
- 45% Quizzes
- 10% Paper summaries and class participation

Pre-requisites:

Graduate standing in engineering or permission of instructor. There will be no computer science prerequisites for this offering of the course, but you should have had at least one programming course.

Collaboration policy:

Feel free to discuss homework problems with other students currently taking the class, but if you do so, give them credit and describe their contribution in your write-up (and/or describe your contribution if you helped someone else). You should always work on the homework by yourself first before you discuss it, except for problems where it is specifically indicated that they are to be done with another student. Keep in mind that “discussion” does not mean giving someone else an answer. You must always do your own coding and your own write-ups. Do not share copies of any code or allow someone else to look at your code or write-ups for any reason. Do not copy or consult anyone else’s code or anyone else’s write-up. You also must not consult anyone not in the class (except the professor or GSI of course), or consult any references besides those provided in the class or general math or programming references, for help on the homework. Please ask me if you have questions about what is or is not allowed. Copying,
allowing someone to copy, or getting outside help could result in a score of zero on an assignment. (And quizzes are of course to be done individually!)

**Required Materials:**

Several of the homework assignments will require programming in Matlab. Matlab is available on the computers in the CAD labs in 10 Jacobs and in 1171 Etcheverry, but only when a class is not meeting in the room. There is no required textbook. Required reading will be handouts and research papers that will be distributed in class or made available via the course web site.

**Course Topics:**

Applications drawn from:

- CAD/CAM
- Robot Motion Planning
- Inspection
- Reverse Engineering
- Mold-making/Casting
- Morphing
- 3D Printing
- Fixturing
- Tolerancing

Tools & Techniques drawn from:

- Solid modeling
- Graph-based methods
- Offsets
- Medial axis transforms (skeletons)
- Space and data partitioning
- Minkowski sums
- Voronoi diagrams
- Delaunay triangulations
- Numerical accuracy and robustness
- Boundary representations (B-reps)
- Constructive Solid Geometry (CSG)
- Mesh simplification
- Boundary healing

**Contacting me:**

I have an RSI from too much typing, so please always include a phone number in all emails.