

ME171
Computer-Aided Engineering Design
Spring Term, 2001
Course Outline

1. Introduction
 - (a) What is Design?
 - (b) What is CAD?
 - (c) What is the state of the art?
 - (d) What are the objectives of this class?
 - (e) Overview of the Engineering Design Process
 - (f) Functional Modeling/Decomposition for Design (Pahl and Beitz)
2. Basic Computing (briefly)
 - (a) Number Systems, Primitive Operations, Boolean Logic and Algebra
 - (b) Von Neuman Computer Architecture
 - (c) Languages
3. Engineering Computer Graphics (briefly)
 - (a) Scaling, Translations and Rotations (2D and 3D)
 - (b) Homogeneous Coordinates and Transformations (2D and 3D)
 - (c) Viewing Transformations and Projections: Orthographic, Perspective
4. Introduction to Vtk, the Visualization Tool Kit
5. Curves
 - (a) Interpolation (Linear, Polynomials)
 - (b) Parametric Curves
 - (c) Piecewise Polynomials
 - (d) Cubic Splines, B-Splines, Bezier Curves
6. Surfaces
 - (a) Ruled (etc.) Surfaces
 - (b) Patches

7. Introduction to Solid Modelling
 - (a) WireFrame Models
 - (b) Boundary Models
 - (c) Constructive Solid Geometry (CSG)
 - (d) SDRC Ideas
 - (e) PTC Pro-Engineer
8. Optimization
 - (a) Single-Variable Optimization
 - i. Approximation Methods
 - ii. Search Methods
 - (b) Multi-Variable Optimization
 - i. Search Methods
 - ii. Gradient Methods
 - (c) Constrained Optimization
9. Imprecision in Engineering Design
 - (a) Background
 - (b) Trade-Offs
 - (c) Noise: Uncontrolled Variations
 - (d) Tuning Parameters
 - (e) Aggregation
 - (f) Indifference Points
 - (g) Vehicle Design Example
10. Design Synthesis Methods
 - (a) Evolutionary Search
 - i. Genetic Algorithms
 - ii. Simulated Annealing
11. Mechanism Simulation (time permitting)

Class Web Page: <http://www.design.caltech.edu/Courses/ME171/>

TA: Cin-Young Lee, 310c Thomas, email: me171ta@design.caltech.edu