ME 232
“Geometric Modeling for Engineering Applications”
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About the course:
• 2 common lectures per week
• 2 lab sessions per week

Common lectures:
• Presentation of conceptual and theoretical material on modeling principals
• 7 to 10 Assignments given in lecture
• ALL examinations will be drawn from this lecture material

Lab sessions:
• Applications and demonstrations of concepts
  – Peer learning techniques
• “Hands-on” exercises using various software applications.

Electronic Data Transfer
• E-mail
  – Student questions
  – Announcements
• Course Web page
  – Assignments
  – Lecture notes
  – General information
• Electronic DropBox
  – Assignment submission using “submit” function

Assignment #0.1
• Verify your UNIX account
• E-mail me a message
  – Subject line will be your section (e.g. 301)
  – Body of message will contain:
    • Your name
    • your UNIX login-name
    • Your preferred e-mail address (will be used for announcements)
Grading:
- 50% from lecture material
  - 40% from exams
  - 10% from lecture assignments
- 50% from lab material
  - Including lab participation

Tests
- 3 total, including final
  - 2 semester tests
    - 100 pts. each
    - Administered in lecture sessions (1 hour)
  - Final exam
    - 100 pts. (covers last material from last 5 weeks of class)

Material covered:
- 11 weeks, Geometrical modeling principals
- 4 weeks, Tolerances and relationship to assembly, also design annotation

Geometric Modeling Topics
- Types of models, characteristics
- Uses, advantages, disadvantages
- Relationship to:
  - engineering design
  - analysis
  - manufacturing

Modeling section objectives
- Representation of geometric elements
- Strengths and limitations of different model representation schemes
- Relationship of modeling to design and manufacturing.

How objectives met
- Examine model characteristics in lecture
- Use of software in lab to demonstrate concepts
Tolerancing and Design Annotation

- Engineering drawing notations and specifications
- Geometric tolerancing principals

Section objectives

- Be able to read, write and identify standard (ANSI/ASME) annotations used in design specification.
- Understand the basic concepts of geometric tolerancing principles.
- Reinforce basic engineering graphics representation concepts.

Modeling

- Creating symbolic models of the physical world has long been a goal of mathematicians, scientists, engineers, etc.
- Recently technology has advanced sufficiently to make computer modeling of physical geometry feasible.

What is "geometric modeling"?

The process of constructing a complete mathematical description (geometric database) to model a physical entity or system.

Modern Systems

- Permit the encoding of the mathematics of geometry in computer programs which hide most of the complexities of generation from the user.
- Allow for operations such as:
  - creating specific shapes based upon input parameters (curve, rectangle, sphere)
  - positions these entities within a “model space”
  - combining basic entities to create more complex geometries.

Basic Geometric Modeling

These concepts in a basic form are common place today for example:

GUI’s (graphic user interfaces) which allow rectangular areas to be created, sized and moved.

e.g. Pulldown menus, scroll bars, and “windows” in programs and operating systems
Geometric Modelers

What constitutes a geometric modeler depends upon application.
The GUI could be considered a 2D ("flatland") modeler.
Systems for VR, games, and animation create images of good appearance using simple model representations.

Approximation Modelers

These simple representations are sufficient for applications where accuracy is not critical (such as those listed previously).
Since the representations are based upon approximations of shape, they are of limited use for engineering applications.

Modelers for Engineering

Modeling for engineering applications require higher accuracy of representation.
Engineering models are used in computer-based design, manufacturing and analysis.

Model types:
• Depending upon the representation scheme used models may be divided into general subdivisions of:
  – wireframe models
  – surface models
  – solid models

Geometric modeling used:
• to produce final design solutions as well as ...
• inputs to the production process in the form of computer databases.

How does geometric modeling fit into a modern design sequence?

Computer-based geometric modeling is used to:
  visualize,
  analyze,
  document,
  produce a product or process.
Concurrent Design

- Traditionally, engineering design has been a very sequentially structured procedure.
- Advances in modeling techniques (and technologies)
  - driven a change in engineering design philosophy, from sequential to concurrent design.

Concurrent design

- The geometric model is the “common denominator” in design, analysis, and manufacturing processes.
- Model database exists at the center of the concurrent design “triad”.

CAD model relationship to design sequence

Production Graphics

Geometric modeling

produce an appropriate database used for input into specialized engineering software tools to perform tasks in an integrated design sequence.

support the move to a seamless work environment where the flow of data is continuous and need not recreated at each stage of design development.