IEEM 5357 CAD/CAM Spring 2019

Instructor: Professor Chih-Hsing Chu (瞿志行)
First Engineering Building, Room 823, 5742698
Class Time: Thursday 9:10-12:00
Course Website: TBA
TA: 姚明鏡 Room 727, 33931

Textbook: Interactive Curves and Surfaces, (with Multimedia Tutorial on CAGD), A. Rockwood and P. Chambers, Morgan Kaufman Publishers, Inc.

References:

Class-notes and related reading materials.

Course Description:

CAD/CAM (Computer Aided Design/Computer Aided Manufacturing) software tools are commonly used in industry, and have become one of the most important automation technologies in modern design and manufacturing. This course introduces <u>mathematical backgrounds/principles of free form modeling</u> behind modern CAD/CAM systems, with focuses on basic concepts of 3D geometric transformations, curve and surface modeling, geometric processing algorithms, and their applications in CNC (Computer Numerical Control) machining. Students should have good understanding in calculus and basic programming skills, but prior CAD software experience is not required.

There will be 6~7 programming and 3~4 hand-written assignments in this class. $Rhino^{TM}$ $Python$ will be the major implementation platform for those programming assignments. Introduction training $Rhino^{TM}$ $Python$ will be arranged. $CATIA^{TM}$ and NCL^{TM} Postworks will be used to demonstrate integration of CAD/CAM/CNC.

Students must complete a term project in group. The project will most likely involve programming tasks. You are encouraged to prepare the term project as early as possible and properly combine it with your research work.

Grading: Homework 40% + Midterm 30% + Final Project 30%

Course Contents:

1. **Basic Concepts of 3D Coordinate Transformations**
   - Vectors and related operations
   - 3D coordinate transformation: rotation, translation, scaling, and mirror
   - Applications

2. **Curve Modeling**
   - Parametric/Nonparametric Forms
   - Curve Interpolation/Approximation
   - Lines, Circles, and Conic Curves
   - Hermite Curves, Bézier Curves, B-Spline, and NURBS Curves
   - Rational Curves
   - Curve Estimation by the Blossom Scheme

- Continuities and Composite Curves
- Geometric Processing for Curves

3. **Surface Modeling**
   - Coon's Patch, Bi-cubic Patch, Ruled Patch, Developable Patch
   - Bézier, B-Spline, and NURBS Surfaces
   - Differential Geometry of Curves and Surfaces

4. **Geometric Processing Operations**
   - Solving Nonlinear System Equations
   - Intersection, Surface Construction, Offset

5. **Computer Aided Manufacturing**
   - Fundamentals of computer numerical control (CNC)
   - Part programming in CNC: NC Code
   - Part programming in CNC: APT
   - Multi-Axis Free Form Machining
   - CNC Post Processing
   - Geometric Processing in 3D Printing