ME 6663: Advanced Digital Design and Manufacturing
Spring 2018

INSTRUCTOR:
Dr. Ming C. Leu, Keith and Pat Bailey Chair Professor
Department of Mechanical and Aerospace Engineering
Office: 321 Engineering Research Lab
Phone: 573-341-4482, e-mail: mleu@mst.edu

MEETING TIME AND LOCATION:
Tu & Th 9:30-10:45AM, Library G14

OFFICE HOURS:
TBD

TEXTBOOK:
None. Handouts will be provided for lectures throughout the course.

COURSE DESCRIPTION:
This course covers selective topics that are essential to advanced digital design and manufacturing, which include reverse engineering, freeform modeling, additive manufacturing, NC machining, and virtual/augmented reality. Students will learn fundamental methodology and practical knowledge on these topics. The course is available to both on-campus and distance students.

PRE-REQUISITE:
ME5708 or ME5763 or consent of the instructor.

GRADING:
Homework Assignments: 30%
Literature Review Project: 15%
Term Project: 25%
Final Exam: 30%

Notes:
1) For the Literature Review Project, each student is asked to provide a written report (5-10 pages in text, single spacing, Times New Roman font 12, plus figures and tables) and an oral presentation (12-15 minutes) based on literature review on a self-chosen topic that is relevant to digital design and manufacturing. The literature review could be based on 4-5 high-quality journal papers. Consult the instructor if you have any questions. The due date of the written report and the date of oral presentation for the literature review will be announced in the class.

2) For the term project, you can work on the project by yourself or team up with another student in this class. You can decide on what project to work on, as long as it is relevant to digital design and manufacturing. The project may be related to your thesis or your current company work (for distance students). The term project will include a proposal (1-2 page text), a written report (5-10 pages in text, single spacing, Times New Roman font 12, plus figures and tables), and an oral presentation (10-12 minutes). The due dates of the project proposal and the written report and the date of oral presentation will be announced in the class.
Course Coverage

1. Introduction
   - What is reverse engineering?
   - What is freeform modeling?
   - What is additive vs. subtractive manufacturing?
   - What is virtual/augmented reality?
   - What are covered in this course?

2. Reverse Engineering
   - Sensing techniques for CAD modeling
   - Sensing techniques for motion capture
   - From a point cloud to triangular patches

3. Freeform Modeling
   - Mathematical formulations of freeform curves and surfaces
   - NURBS (Non-Uniform Rational B-Spline) functions
   - Determine parameters for NURBS curves and surfaces
   - Generate NURBS curves and surfaces using Matlab

4. Additive Manufacturing and NC Machining
   - Additive manufacturing technologies and processes
   - Path generation for additive manufacturing
   - Geometric analysis of NC machining
   - NC machining path generation and code verification

5. Virtual and Augmented Reality
   - Introduction to virtual reality and augmented reality
   - Graphic rendering for stereoscopic viewing
   - Haptic and auditory rendering