University of Arkansas, Fayetteville

MEEG 491V/591V Additive Manufacturing Spring 2015

Location & Time: MEEG0228 & Tuesday and Thursday 3:30pm – 4:45pm

Instructor: Professor Wenchao Zhou
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Office Hours: 4:50pm -5:50pm Tuesday and Thursday or by appointment

Text: *Gibson, Rosen, Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing. Springer, 2009*

Catalog Info: This course provides an overview of developing opportunities and critical challenges of additive manufacturing (AM, also known as 3-D printing). It covers existing and emerging additive manufacturing processes in the context of product design, materials selection and processing, and industrial and consumer applications.

Prerequisites: MEEG 2100 CAD, MEEG 2303 Intro to Materials, MEEG 3013 Mechanics of Materials, and MEEG 3503 Mechanics of Fluids. Or instructor consent.

Objectives:

1. To provide a survey of existing and emerging AM processes.
2. To provide an overview of the emerging opportunities and critical challenges for deploying AM technologies in industrial and home/office settings.
3. To learn how to build a 3D printer.
4. To introduce the fundamental concepts and physical principles underlying AM processes.
5. To understand the unique advantages of AM technologies and their limitations for existing and emerging applications.
6. To provide hands-on laboratory experience with AM technologies.

Topics:

A. Introduction

1. What is additive manufacturing?
2. How does it work?
3. What are the opportunities?
4. What are the challenges?

B. Build a 3D Printer

1. Hardware: mechanical system and electronics
2. Software: software toolchain

C. Design for additive manufacturing

1. 3D content creating: 3D scanning + surface/solid modeling for CAD systems
2. Design opportunities for complex geometry (e.g., lattice structure)
3. Design opportunities for material composition (e.g., multi-material and multi-scale structure)
4. Design opportunities for manufacturing process (e.g., optimization of processing parameters over time and space)

D. AM processes and materials

1. Beam deposition processes

2. Printing-based processes
3. Extrusion-based processes
4. Powder bed based processes
5. Sheet lamination processes

E. Economics of AM and Future Directions

F. Applications
1. Printed electronics/Flexible electronics
2. Bio-medical devices
3. Aerospace parts and systems

Grading: the grading for the class will be determined using the following weights:

Assignments:	**15%**
Literature review project (individual):	**20%**
Report	15%
Presentation	5%
Technology survey project (individual):	**15%**
Report	10%
Presentation	5%
Design project (Team):	**45%**
Proposal	5%
Demo	5%
Final report	30%
Presentation	5%
Participation:	**5%**
Total Score:	**100%**

In all team project reports, please describe the contribution of each individual team member. Team projects will be graded on both individual and team basis. Your score for the team projects will be the average of your individual score and the team project score.

Policies:

1. **Attendance**: Class attendance and participation is strongly recommended, which accounts for 5% of your total grade. You are responsible for any announcements, handouts, or assignments made in class if you miss any class.
2. **Assignments and projects**: Working together or in a team are encouraged. However, assignments are to be completed individually except for the team project, that is, you **MUST** turn in your own work! Assignments need to be turned in on the specified due dates. Electronic submission by email is preferred.
3. **Academic honesty and integrity**: all students are required to adhere to the values of academic honesty and integrity and violations will be processed according to the academic integrity policy at the University of Arkansas.
4. **Communication**: Blackboard and email will be the formal means of communication of this class. All the announcements, assignments, and course materials will be posted on Blackboard.
5. **Lab Policy**: You will have access to the lab in ENRC 4623 during the semester. When in the lab, always wear safety goggles and use caution. Wear gloves when necessary. Do not perform any potentially risky operation when no one is around. Do not take any lab properties out without permission. Always ask when unsure.
6. **Project Budget**: A detailed list of items (including supplier, model number, price, and sufficient justification) needs to be submitted for approval before any purchases.