HKUST(GZ)

SMMG 3020 Introduction to Additive Manufacturing

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Teaching Assistant:

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Optional textbook: "Additive Manufacturing Technologies", Gibson, Rosen, Stucker

Class schedule: Monday (6pm to 8:50pm)

Office hour: Tuesday (10am to 11am)

Grade Composition:

1. In-class test: 10%
2. Mid-term test: 40%
3. Final Exam: 50%

Course Description:

This course will study methods used in additive manufacturing, theories governing the additive manufacturing, give information on materials, explain relations between materials to be processed and methods of additive manufacturing with introduction to common machines used for the technology and show applications and business opportunities with future directions. The students also will gain the ability to manufacture a 3D part by using some of the methods of additive manufacturing.

Objectives:

This course aims to introduce the fundamentals of state-of-the-art techniques and also the latest research trends in additive manufacturing. This course allows the students to get familiar with different types of additive manufacturing techniques and select suitable methods for various application scenarios. The processes, materials, design considerations and applications will be included in the course, making it possible for the students to take the leadership of manufacturing systems or platforms in their future life.

Course outline:

- Introduction to additive manufacturing

1. Development of additive manufacturing technologies in the past decades.
2. Additive manufacturing technology overview.
3. Industry applications of additive manufacturing techniques.

- Additive manufacturing fundamentals

1. Photopolymerization: projection stereolithography, laser scanning stereolithography, two-photon lithography.
2. Powder bed fusion: metal, polymer
3. Extrusion based additive manufacturing: polymer, composites
4. Material jetting
5. Binder jetting

- Research trends in additive manufacturing

1. Emerging printing methods: multi-material stereolithography, volumetric 3D printing, roll-to-roll stereolithography, etc.
2. Functional material printing
3. Direct printing of multi-functional devices
4. 3D printing company introduction

- Design consideration of additive manufacturing

1. Process chain, cost analysis
2. Policy implications

- Gust lectures by other professors or engineers in additive manufacturing
- Assembly of FDM/SLA printers

Learning outcomes:

At the end of the course, students should be able to

1. Recognize the development of additive manufacturing in the past decades

2. Demonstrate fundamental understanding of energy transfer additive manufacturing techniques, such as projection stereolithography, laser scanning stereolithography, two-photon lithography

3. Demonstrate fundamental understanding of material transfer additive manufacturing techniques, such as fused deposition modeling, ink jet printing and

binder jetting

4. Apply the knowledge and techniques of additive manufacturing to real problems

5. Demonstrate the capabilities of combing additive manufacturing, date science and control science

6. Demonstrate analytical skills and critical thinking related to smart manufacturing

7. Apply cross-disciplinary knowledge and skills in data analytics, real-time sensing, and optimal planning to improve manufacturing process capabilities

8. Evaluate the present smart manufacturing techniques and markets and perform a critical analysis of the trends