The Chinese University of Hong Kong
Department of Mechanical & Automation Engineering
2nd Term, 2022/2023

Course Code & Title: MAEG 5160 Design for Additive Manufacturing

Time and Venue of Lectures

Monday	11:30a.m. – 12:15 p.m.	LSK 304
Wednesday	16:30p.m. – 18:15 p.m.	MMW 703

Instructors and Teaching Assistants

Instructor	
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Teaching Assistants			
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Course Description & Content

This course provides a theoretical and practical guidance on how to design parts to gain the maximum benefit from what additive manufacturing (AM) can offer. It begins by describing the main AM technologies and their respective advantages and disadvantages. It then examines strategic considerations in the context of designing for additive manufacturing (DfAM), such as designing to avoid anisotropy, designing to minimize print time, and post-processing, before discussing the economics of AM. The course then focuses on computational tools for design analysis and the optimization of AM parts, part consolidation, and tooling applications. Both designing for polymer AM and metal AM and its corresponding design guidelines will be provided. The main benefit of the course is its combined theoretical and practical approach, which provides directly applicable, "hands-on" information and insights to help students adopt AM in their daily practice.

Learning Outcomes

Upon completion of the course, students should have achieved the following outcomes:
(1) Explain the topological optimization algorithms used in existing CAD/CAE systems;
(2) Apply mathematical formulations in their programming implementation for topological optimization;
(3) Understand and apply different design rules for polymer and metal Additive Manufacturing;
(4) Understand advantages and disadvantages of different Additive Manufacturing Technologies and corresponding design constraints.

Learning Activities (M: Mandatory activity O: Optional activity)

Activities	Number of Hours		Nature of Activities
Lecture	In class	2.5 per week	M
	Outside class		O
Project and Assignment	In class		O
	Outside class	2.5 per week	M

Assessment Scheme

Task nature	Percentage
Homework or assignment	40%
Project + final report	20% + 10%
Short answer test or exam (non-centralized)	30%

Course Schedule (Tentative)

Wk	Date	Lecture (1st 45 minutes, 2nd 1 hour 30 minutes)
01	Jan 9, 11	Introduction to AM, AM economy, and different AM technologies
02	Jan 16, 18	Design for polymer AM and metal AM
03	Jan 23, 25	Lunar New Year Break
04	Jan 30, Feb 1	Digital Design for AM and Generative Design
05	Feb 6,8	Topological Optimization for isotropic material
06	Feb 13,15	Topological Optimization for isotropic material (continue) (release of 1st assignment)
07	Feb 20,22	Topological Optimization in different applications
08	Feb 27, Mar 1	Topological Optimization in different applications (continue) (release of 2nd assignment)
09	Mar 6, 8	Topological Optimization for anisotropic material (collect the 1st assignment)
10	Mar 13, 15	Topological Optimization for truss structure (release of the final project)
11	Mar 20, 22	TO2AM and introduction to optimization (collect the 2nd assignment)
12	Mar 27, 29	Lattice structures, consolidation, tooling and postprocessing
13	Apr 3, 17	Future outlook (0.5 sessions ~15 mins, Class Revision (1.5 sessions, ~75 mins)
14	Apr 10, 12	No class (collect the final project)
15	Apr 19	Examination in class (1 session, 1.5 hours)
16	Apr 24	Case study of AM in Aerospace (make-up class, LSB C1 at G/F of Lady Shaw Building)

Learning Resources

Reference materials will be provided in the lecture notes and online in the blackboard. Examples showed in the lectures with source codes are also included online in the blackboard.

Academic Honesty

Read the university's policy dealing with academic dishonesty and plagiarism at http://www.cuhk.edu.hk/policy/academichonesty/.

Reference books

1. Martin Bendsoe, Topological Optimization. Theory, Methods and Applications, Springer, 2004
2. Olaf Diegel, A Practical Guide to Design for Additive Manufacturing, Springer, 2019
3. Martin Leary, Design for Additive Manufacturing, Elsevier, 2019