

Syllabus

MECH 5352: Design for 3D Engineering and Additive Manufacturing Spring 2023

Time: MW 1:30 - 2:50 PM
Room: Classroom Building C305

INSTRUCTOR: Dr. David Espalin (Assistant Professor, e-mail: despalin@utep.edu;
office: Engineering Building Room A105)

OFFICE HRS: Monday and Wednesday 11:00 AM – 12:00 PM
or by appointment

Course Description and Goals:

The MECH 5352 course is the second class towards the Graduate Certificate in 3D Engineering and Additive Manufacturing (AM). The instruction is targeted towards practicing engineers or soon to graduate engineering students seeking exposure to the various AM technologies for a career in this growing field. The course will introduce topics related to designing for AM which will include the use of several software tools. Topics of interest include generative design, analysis of residual stresses and distortion in AM parts, finite element analysis and topology optimization, generation of support structures, generation of stochastic and mesh structures, etc. Technology specific design considerations and constraints will also be discussed.

Upon completion of this course, each student should be able to:

- List and describe the seven AM process categories
- Use Autodesk Fusion 360 to design parts and assemblies to be fabricated with AM
- Examine solid models to identify stress concentration features using finite element analysis
- Discuss the feasibility of successfully fabricating a variety of parts with AM
- Predict the impact of part orientation on fabrication results
- Critique the effectiveness of support structures

TEXTS:

Additive Manufacturing Technologies : Rapid Prototyping to Direct Digital Manufacturing 2nd Ed. by Ian Gibson, David W. Rosen, Brent Stucker, Mahyar Khorasani, Springer, 2021, ISBN: 978-3-030-56129-1. **(optional) Available online through UTEP's library.**

3D Printing and Additive Manufacturing: Principles and Applications by Chee Kai Chua, Kah Fai Leong, World Scientific Publishing Co., 2015, ISBN: 978-9814571401 **(optional) (TS155.6 .C498 2010)**

REFERENCES FOR SOFTWARE

This class will implement various software packages offered by Autodesk. Specifically, two of the software that will be used are Autodesk Fusion 360 and Netfabb. Therefore, students are encouraged to visit the respective websites for the most updated information and to start getting the software installed in their personal computer or laptop. When creating profiles, please use your UTEP email address as privileges from Autodesk will recognize your UTEP email address.

Fusion 360: <https://www.autodesk.com/products/fusion-360/overview>

Netfabb: <https://www.autodesk.com/products/netfabb/overview>

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SOME ADDITIONAL REFERENCES:

1. Wohlers, T., "Wohlers Report 2020: State of the Industry," Wohlers Associates, Annual Worldwide Progress Report, 2020.
2. Liou, F., 2008, *Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development*, CRC Press, Boca Raton, FL.
3. Hopkinson, N., R. Hague and P. Dickens, Eds., 2006, *Rapid Manufacturing: An Industrial Revolution for the Digital Age*, John Wiley, New York. (TS171.4 .R34 2006)
4. Kamrani, A. K. and E. A. Nasr, 2006, *Rapid Prototyping: Theory and Practice*, Springer, New York, NY. (TS171.4 .R357 2006)
5. Noorani, R.I., *Rapid Prototyping: Principles and Applications*, John Wiley & Sons, 2005. (TS155.6 .N66 2006)
6. Gibson, I., Ed., 2005, *Advanced Manufacturing Technology for Medical Applications: Reverse Engineering, Software Conversion and Rapid Prototyping*, John Wiley & Sons, Chichester, UK.
7. *Proceedings of the Solid Freeform Fabrication Symposium*, The University of Texas at Austin, Austin, Texas. (1990 – present), see <http://utwired.engr.utexas.edu/lff/symposium/> for searchable papers from 1990.

In addition to the listed textbook references, students are encouraged to search current literature on the topic of additive manufacturing since they provide the most current advances and developments in AM and these could be helpful for a broader understanding of the subject. Also, discussion activities will be performed based on assigned readings for journal articles from these sources. Two repositories recommended, which are accessible through the UTEP's network, are:

1. www.sciencedirect.com
2. www.springerlink.com

ASSIGNMENT DEADLINES:

All assignments must be submitted on time. Files will be provided that will indicate the important dates for each project or assignment. **No late assignments will be accepted and a grade of zero (0) will be assigned for any work not delivered on time**

METHOD OF EVALUATION

Your **grade for this course will be assessed based on your attendance, quizzes, homework, and lecture-related activities that will count a total of 10%, and two exams each at 30%. Finally, projects will count 30% of your grade.** There will be no make-up quizzes. Two exams will be given during the semester. Make-up exams will be given only for extremely credible reasons. The number of projects throughout the semester will be defined later but a minimum of 2 projects can be expected. No late work will be accepted for project's work and deliverables.

GRADING

Your final grade will be calculated based on the points you have accumulated as follows:

A	≥90
B	≥80 but <90
C	≥70 but <80
D	≥60 but <70
F	<60

The instructor reserves the right to revise this grading plan. However, students will be informed of any changes during the semester.

*** For further class policies, please refer to the MECH 5352-Class Addendum**