SE402 – Computer-Aided Product Realization

Fall Semester 2023

Instructor: Prof. Molly Goldstein 309 Transportation 300-8169 mhg3@illinois.edu

Teaching assistant: Simon Zhang (czhan106@illinois.edu)

Credit: 3 (or 4) credit hours

Meeting Times: Monday/Wednesday 2-3:20 Mostly in 316TB, and with announcement in 207 TB

Prof. Goldstein Office hours and location: Mondays 11:30-12:30 309TB and by appointment. Simon and open lab hours will be posted on Canvas.

Preferred method of contact: My preferred method of contact is in-person during office hours or during class. I will also respond to email messages and can set up separate appointment times, but please keep in mind that I make take a full day to respond. Please include SE402 in the subject line of all emails.

Course Description:

In the first half of the course students are introduced to a variety of design tools, including cloud-based, freeform CAD for modeling and design collaboration, 3D printing, 3D scanning and scan data processing, simulation for design engineers, and rendering and animation. Working in teams, students then use these digital prototyping tools to design and prototype a product or device.

Text:

No text required; readings on CAD and design topics are assigned

Tools:

Software	**Hardware**
Autodesk Fusion 360	Dimension SST 1200, Elite 3D printers
Creaform VXelements	Creaform portable scanner (structured light)
Geomagic Design X	Collaboration tables (4)
Autodesk ReCap Photo	Newline 80” multi-touch display
Autodesk Netfabb	

Assessment:

Fusion tutorials (FT) ~8	10%
Fusion assignments (FA) ~5	15%
Scan and print tutorials (ST) ~3	5%
Scan and print projects (SP)	15%
Online portfolio	10%
Product design project (DP)	40%
Reading reflections (R)	5%

Course Goals:

1. Expand upon existing CAD skills using parametric and direct solid modeling.
2. Use T-Splines to develop sculpted, watertight geometry.
3. Understand the various capabilities and weaknesses of parametric solid, direct solid, NURBS, and T-Splines modeling.
4. Gain hands-on experience using 3D printing and 3D scanning.
5. Gain experience using digital prototyping tools used for visualization and simulation.
6. Promote multidisciplinary collaboration between engineering and industrial design.
7. Use cloud-based 3D CAD for collaboration.

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Week	Date	Topics	Demo (Training)	Tutorials (Training)	Assignments/Projects	Reflections, Quizzes
1	8/21 8/23	CAD & Design Intro to DP	Fusion	Sketch (FT1)		
2	8/28 9/30	Solids What is Design; Problem Scoping		Solid (FT2)	Model (FA1)	What is design? (R0)
3	Labor Day 9/6	Assembly Modeling		Assemble (FT3)	Assembly (FA2)	
4	9/11 9/13	Curves & Surfaces Science of Design; Concept Generation		Form (FT4)	Assembly (FA2a)	Science of Design (R1)
5	9/18 9/20	Lab time *Team Design Pitches*		Surface (FT5)	Sculpt (FA3)	Two Design Paradigms (R2)
6	9/25 9/27	Freeform Modeling Model Evaluation & Analysis	Fusion	Drawing (FT6)	Sculpt (FA4)	Engineering Design Thinking (R3)
7	10/2 10/4	Curve Evaluation Prototyping				CC Subdivision Modeling (R4)
8	10/9 10/11	Scanner Hardware ½ class Scanner Hardware ½ class	VXelements	Geomagic (ST1)	Scan to Mesh (SP1)	T-Splines (R5)
9	10/16 10/18	Scanner Software ½ class Scanner Software ½ class	Geomagic ReCap Photo	Geomagic, ReCap, Fusion (ST2)	Scan to CAD (SP2)	
10	10/23 10/25	Team time *Design Review (DR1)*				
11	10/30 11/1	Additive Manufacture Iterating	Catalyst Netfabb	Netfabb Lattice (ST3)	Netfabb Lattice (SP3)	
12	11/6 11/8	Simulation Team time		Simulation (FT7)	Simulation (FA5)	
13	11/13 11/15	*Design Review (DR2)* Portfolios		Generative Design (FT8)		
14	11/20	Thanksgiving Break				
15	11/27 11/29			Render & Animation (FT10)		

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16	12/4 12/6	Team time Team time				Informed Design (R6)
Finals week	12/12	**Final Presentations and Portfolios, Tuesday, December 12th 1:30-4:30pm**				

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Department of Industrial and Enterprise Systems Engineering
University of Illinois Urbana-Champaign

SE 402 FA23 - Assessment Due Dates

Fusion tutorials (FT) and Scanning Tutorials (ST) – due on Wednesdays

Fusion Assignments (FA) – due on Fridays

Reflections (R) and Scanning Projects (SP)– due on Mondays

Assignment	Weight (%)	Due Date
R0 – What is Design	0	M 8/28
FT1 - Sketch	1	W 8/30
FT2 - Solid	1	W 9/6
FA1 - Model	3	F 9/8
R1 – Science of design	1	M 9/11
FT3 - Assemble	1	W 9/13
FA2 – Assembly (robotic arm)	3	F 9/15
R2 – Two design paradigms	1	M 9/18
FT4 - Form	1	W 9/20
FA2a – Assembly (car stand)	3	F 9/22
R3 – Engineering design thinking	1	M 9/25
FT5 - Surface	1	W 9/27
FA3 - Sculpt	3	F 9/29
R4 – Subdivision modeling	1	M 10/2
FT6 - Drawing	1	W 10/4
FA4 – Sculpt (bike frame)	3	F 10/6
R5 – T-Splines	1	M 10/9
ST1 – Geomagic scan to mesh tutorials	2	W 10/18
DR1 – Project design review 1	-	M 10/23
SP1 – Scan to Mesh	5	M 10/23
ST2 – Geomagic, ReCap, Fusion mesh	2	W 10/25
SP2 – Scan to CAD	5	M 10/30
ST3 – Netfabb lattice	1	W 11/8
DR2 – Project design review 2	-	M 11/13
FT7 – Simulation	2	W 11/15
FA5 - Simulation	3	F 11/17
FT8 – Generative Design	1	W 11/29
R6 – Informed Design	2	M 12/4
FT9 – Render & animation	1	W 12/6
DP – Design project presentation + Portfolio	40 + 10	*Tu 12/12

Assume 1,000 total points