Arch 3690 | Spring 2019
Intermediate Computation and Fabrication

Wed: 10:30am - 12:35pm V-834B | Fri: 10:30am - 12:35pm V-817

Prof. Ravi Raj (rraj@citytech.cuny.edu)
CLT: Henry J Aguilar (haguilar-morales@citytech.cuny.edu)

Department of Architectural Technology
New York City College of Technology
City University of New York
300 Jay Street, Brooklyn, NY 11201

COURSE SYLLABUS

ARCH 3690: Intermediate Computation and Fabrication
1 classroom hour, 4 lab/studio hours, 3 credits
PREREQUISITES: ARCH 1191 Visual Studies I and ARCH 1291 Visual Studies II
ARCH 3590 Introduction to Computation and Fabrication

COURSE DESCRIPTION:

This course, the second in the digital fabrication certificate sequence (following ARCH3590) focuses on the development of parametric tools and digital prototyping techniques and practice. Beginning from the study of precedents of modern architectural fabrication—both digital and non-digital-- the course will develop a comprehensive understanding of exemplary construction and tectonic systems, as well as allowing students to develop a proficiency in applying this knowledge in constructing associative/parametric digital models that utilize tools to generate alternative variations of these systems.

An integral part of the course involves the study of parametric modeling in Rhino 3D, Grasshopper, and Paneling Tools. The output of the course will be a digitally modeled and fabricated panel, with paneling systems involving complex curvatures. Students will have come away from the course with digital and material models, and documentation of the structural characteristics of the materials and fabrication techniques used.

REQUIRED MATERIALS:

Google Drive account and dedicated course Flash Drive (recommended 4GB or more)

REQUIRED TEXT: (Course Readings to be available on the Google Drive in PDF format)

Alayna Fraser, "Translations: de Young Museum and the Walker Art Center," Praxis 9, 2007
An Atlas of Fabrication, Barkow Leibinger, AA Publications, 2009
Digital Fabrication: Architectural and Material Techniques, Lisa Iwamoto, Princeton Architectural Press, 2009
The Function of Ornament, Farshid Moussavi and Michael Kubo, Actar, Barcelona, 2008

RECOMMENDED TEXTS:

Tooling, Pamphlet Architecture 27, Aranda/Lasch, Princeton Architectural Press, 2006
The Function of Form, Farshid Moussavi, Actar, Barcelona, 2009
Atlas of Novel Tectonics, Reiser + Umemoto, Princeton Architectural Press, 2006
Architecture in the Digital Age: Design and Manufacturing, ed. Branko Kolarevic, Taylor & Francis, New York, 2003
From Control to Design:Parametric/Algorithmic Architecture, Michael Meredith, Actar Publishing, New York, 2008
Manufacturing Material Effects, Branko Kolarevic and Kevin Klinger, Everbest Printing Co., China, 2008
Guidot, Raymond (ed.), Industrial Design Techniques and Materials. 2006, London: Flammarion.

COURSE WEBSITES:

http://www.nycctfab.com/
http://www.grasshopper3d.com/
http://www.rhino3d.com/

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COURSE RESOURCES:

• There is an Arch Tech department library in V818 with a number of interesting texts on the topics of digital fabrication and advanced architectural computation. Ask the front desk for assistance obtaining books.
• We have a full digital media assistance site with descriptions and instructions for fabrication equipment, workshop notices, software tutorials, and more at http://www.nycctfab.com/.
• While in the past we've used paper signup sheets, we will now be implementing online laser cutter scheduling at http://www.nycctfab.com/
• Sample Rhino files, Grasshopper definitions and RhinoCAM files will be posted to the class Google Drive folder under "Course Resources"
• Codecademy (http://www.codecademy.com/) is an incredible site for beginners to interactively learn code online
• Professor Downey's site http://www.designalyze.com/ has video tutorials and sample file downloads that correspond with class assignments in Rhino and Grasshopper as well as more advanced videos that build off of concepts learned in class.

FILE SUBMISSION AND NAMING CONVENTIONS:

All digital files should be submitted in native formats (.3dm for Rhino; .ai for Illustrator, etc) and named according to the following system:

ARCH 3690_SP19_Smith_Assignment 01_01, 02, 03, etc
[Course number_Semester_Student Last Name_Assignment Name_File number]

On the final week, a single PDF document archiving all assignments and progress in this course will be submitted. You will have received an invitation to join the course Google Drive folder, which will contain individual folders for each student. You will be expected to create new folders within your individual folder for each new assignment and post your assignment files in the corresponding folders. You may also use these folders to backup your work-in-progress - just remember to make it clear which files are being submitted for grades and which are works-in-progress.

For example, your Google Drive folder hierarchy may look like this:

> Smith_John
>> Assignment 01
>>> ARCH 3690_FA16_Smith_Assignment 01_01.3dm
>>>ARCH 3690_FA16_Smith_Assignment 01_02.ai

RHINO AND GRASSHOPPER:

Remember, Grasshopper information is not saved within the Rhino file and vice versa, therefore you should always be saving both a Rhino file and a Grasshopper file when working on an assignment. If you choose to work in other versions it is at your own risk - so make sure you know how to translate the files and if you are at risk of losing data. You can download Rhino 6 for free for 90 days at https://www.rhino3d.com/download/rhino-for-windows/6/evaluation. Students can purchase their own full copy of Rhino for $140 at Novedge.com.

GRADING:

Assignment 1: 10%
Assignment 2: 10%
Assignment 3: 10%
Midterm Presentation: 20%
Final Fabrication Project: 30%
Reading Group Lecture/Presentations: 10%
Class Participation: 10%

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LEARNING OBJECTIVES: Upon completion of the course, students should be able to -

1. Demonstrate an advanced understanding of digital tools and how they can be applied to solve architectural digital fabrication problems.
2. Demonstrate intermediate / advanced knowledge of parametric software (Grasshopper), including solid modeling, polygons and mesh techniques, and a fundamental knowledge of coding.
3. Demonstrate ease in carrying out iterative workflows across multiple software platforms including modeling, parametric functionality, and analysis.
4. Demonstrate proficiency in detailing, assembly and digital tectonics.
5. Illustrate proficient knowledge of mill set up, basic machine maintenance, and safety procedures.
6. Display proficiency in best practices for 3D modeling for laser cutter operation through surface.
7. Illustrate an understanding of precedents of digital fabrication in other industries [ie. ship building, automotive industry, industrial design.
8. Carry out production/assembly of small-scale prototype(s).
9. Demonstrate flattening/building and contouring, and in operating laser cutters.
10. Demonstrate knowledge for creating profiling, drilling, and surfaces modeling drawings for use with a CNC mill. Show applied understanding of mill software interfaces (RhinoCAM).
11. Combine manual fabrication techniques (such as heat bending and component assembly) with digital fabrication techniques.

ASSESSMENT:

Through computer based and fabrication projects, and oral presentations, students will demonstrate their ability to:

1. Utilize material properties knowledge in producing fabrication projects.
2. Produce digital parametric modeling projects of high complexity.
3. Produce fabrication projects that utilize fundamental skills involving key set up, work flow, and assembly techniques, as well as best safety practice.
4. Design, develop and test details to ensure that project design criteria is met.
5. Produce a robust final prototype that address all material, tooling and performance requirements.

CLASS PARTICIPATION POLICY:

No more than 10% absences are permitted during the semester. For the purposes of record, two late arrivals are considered as one absence. Exceeding this limit will expose the student to failing at the discretion of the instructor due to lack of class participation and mastery of class material.

ACADEMIC INTEGRITY:

Students and all others who work with information, ideas, texts, images, music, inventions and other intellectual property owe their audience and sources accuracy and honesty in using, crediting and citation of sources. As a community of intellectual and professional workers, the college recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension and expulsion.

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COURSE SCHEDULE:

Assignment 1: Glueless Plexi Sphere

Students will be required to construct a sphere or sphere-like object out of 1/8" acrylic plexi. The assembly must be held together without the use of adhesives or hardware.
Due: Friday, February 22nd

Assignment 2: Scaffolding Structure

Part 1 - Students will select a precedent structure from a list and create a research document to present to the class.
Due: Friday, March 1st

Part 2 - Students will design a scaffolding structure focusing on the overall concept.
Due: Friday, March 28th

Assignment 3: Scaffolding Module

Part 1 - Students will develop a smaller portion of the scaffolding, refining materiality, details and methods of fabrication.
Due: Friday, May 3rd

Part 2 - Students will produce a comprehensive design presentation as well as fully fabricated portion of the scaffold.
Due: Wednesday, May 22nd