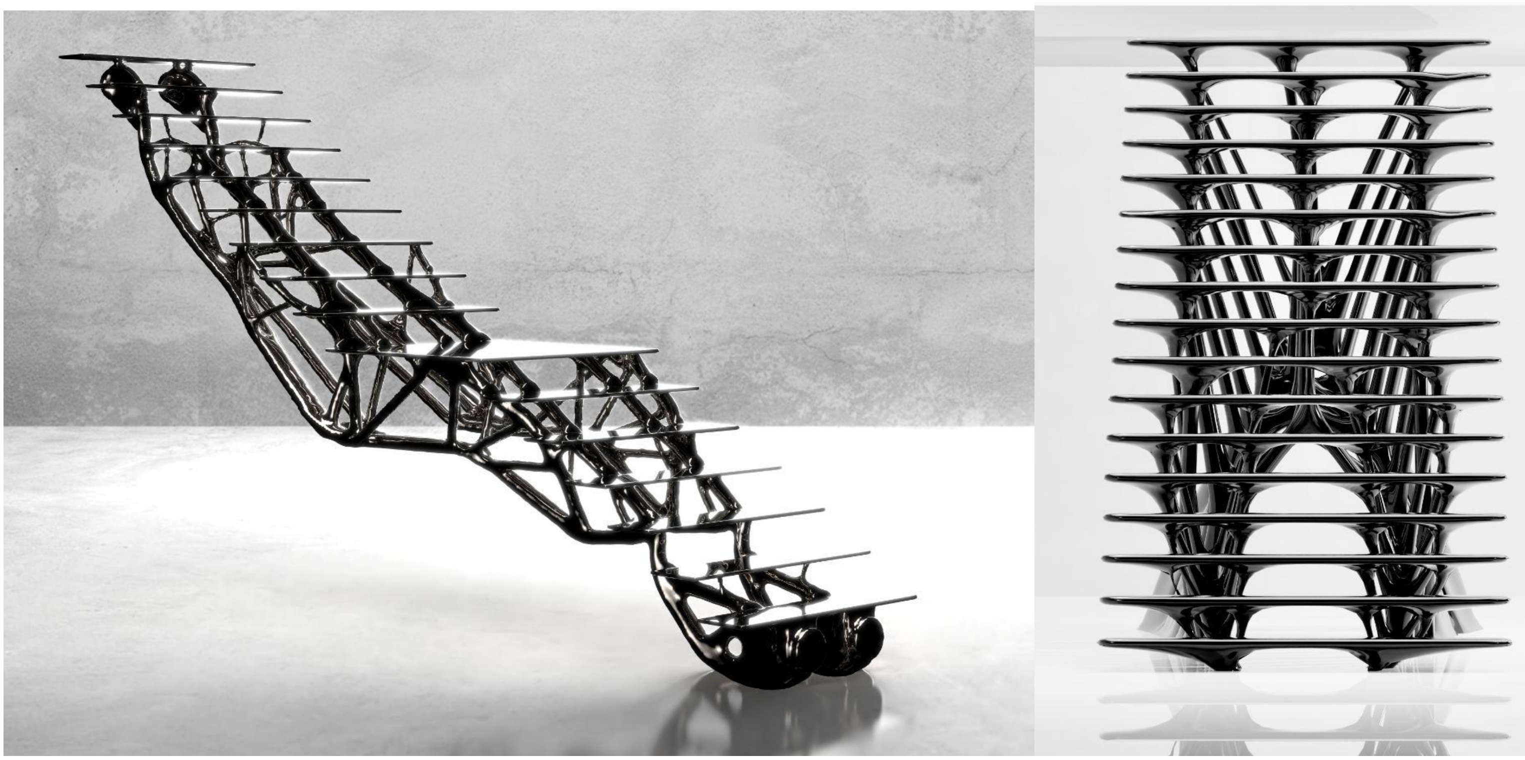
Taubman College of Architecture and Urban Planning | University of Michigan | Fall 2021 | ARCH 709: Computational Geometry | Thurs 8:30-11:30 am | Class Instruction Mode: in person|
Instructor: Mania Aghaei Meibodi | meibodi@umich.edu



Topology optimization of stair way for 3d printing fabrication. Computational Geometry Course 2021, Left image by students Joseph Lico,Katie Shipman and Koami Amegnran. Right image by students Zhuofan Ma, Kamon Nartnarumit, and Anli Zhang.

The intersection of computational design and digital fabrication has changed how we design, analyze, and construct our built environment. Computational geometry is at the core of computational design and digital fabrication processes, from the initial form-finding stages to the actual construction. It is about algorithms and computational techniques, which can be stated in terms of geometry.

Large scale 3-D printing is at a tipping point in building construction. this technology is allows not only enables limitless customization but also for designs of greater intricacy. The Winter 2020 Computational Geometry course will explore and develop algorithms that help students create an architecture of unimaginable forms, intricate geometries, lightweight parts with minimal material, and entirely new spatial articulation. The main topics covered in this course include algorithms, data structures, geometric operations, digital design-to-fabrication workflows. This course is structured around the following main activities: lectures by the instructor and academic and industrial experts, selected readings, computational design workshops, weekly assignments, a midterm, and a final project.

Course Structure

The course is structured around a series of fundamental design problems which progressively introduce students to a variety of computational design techniques and concepts: From understanding Mesh geometry to designing series of Rough Mesh series and to mesh operation such as Mesh Relaxation, Mesh Subdivision, and topology optimization and generative systems that help students to generate form.

Each exercise/concept builds on prior work. Students will ultimately demonstrate their aptitude and fluency in design computation by designing a building element (such as a building envelope, stairway, Slab) or a set of furniture (a chair and a table). Critical handout readings texts will inform work.

Students will work individually and in groups of two. As a result of the geometric freedom offered by 3D printing, students are asked to explore the geometric complexity and rethink the building element and its many functional layers in response to the twenty-first century's environmental, social, economic, and political changes. Because of the fabrication freedom offered by 3d printing, geometric complexity is no longer a constrain but an opportunity.

Course objectives

The primary objective of this seminar is to introduce students to and further their knowledge of computational design techniques. Another purpose is enhancing the agency of the designer when designing and building with these tools. Learning through design is the key objective of this course_one's understanding of the tools through specific design problems and methods.

Software

This course assumes an intermediate working knowledge of computer modeling with the 3D modeler Rhinoceros and Grasshopper. It is expected that students will have a basic understanding of Rhino and Grasshopper. Students will need to provide their laptop – loaded with Rhino 7.0 and the proper software for use during class time. Some software is available for use on computers throughout the Duderstadt and AA Building. Rhino 7.0 is available for purchase at the Media Center.