

## 62-212 Shaping Form: A workshop on parametric design

Spring Semester 2021 Micro • 3 units • Tuesdays + Thursdays 10:00–12:00 (Remote)

Open to all undergraduate students at CMU-Qatar

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**Office Hours:** TBD

### Syllabus

#### MOTIVATION

Geometry is at the very core of visual design—from the very early conceptual form finding to the more detailed assembly and construction. In practice, designers are showing an increasing interest in being able to compute and fabricate non-simple and sometimes intricate geometric forms.

Contemporary approaches to modeling geometry are computational—this is reflected in designers wanting much more parametric control over the generative process; in turn, this enhances the efficiency with which they can navigate design variations, analyze design artifacts and explore design manifestations.

Constructing geometry parametrically and computationally poses challenges for the designer—especially for those with little formal geometry training; more so—when required to tackle evolving issues between complex geometry and design. There is a compelling and emerging need to better understand concepts that support geometric constructions—to develop (new) computational schemes that can intelligently or ably assist designers in managing geometry data and propagating designs.

#### COURSE OBJECTIVE

This introductory workshop is to prepare students in modeling geometry through development of parametric schemes for design applications and products. This course supplies the basics of parametric geometric construction. The course consists of lectures, computer instruction and assignments.

We will be working with Rhino3D®, a modelling environment and the built-in Grasshopper app for parametric modelling.

#### LEARNING OUTCOMES

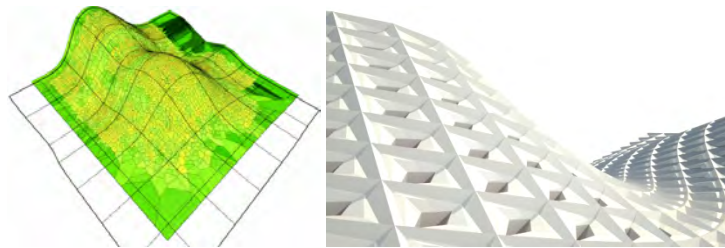
In this course students will:

- Become familiar with visual programming and geometry manipulation
- Model forms and relationships through basic geometric concepts and parametric tools
- Understand basic core structures and workflows of parametric modeling
- Manipulate data flows toward desired design outcomes
- Apply simple algorithmic logic to design problems
- Begin to develop a sensibility for modeling your own designs.

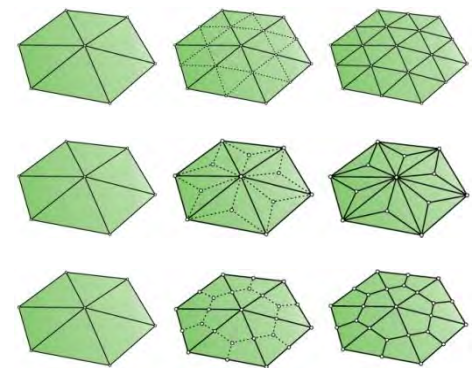
## COURSE TOPICS

The topics covered are:

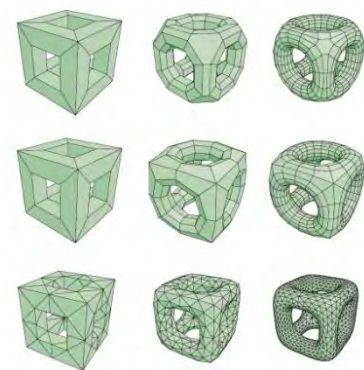
- Basics of geometric modeling: coordinates and transformations
- Surface Construction: Freeform curves to surfaces
- Surface Development: surface offsets, sweeping and evolutions
- Deformations
- Other topics



Surface morphing

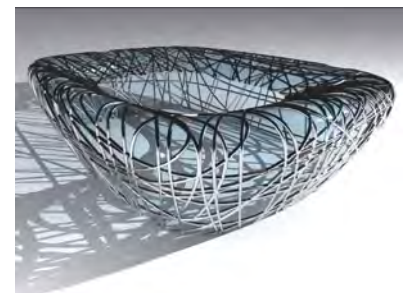
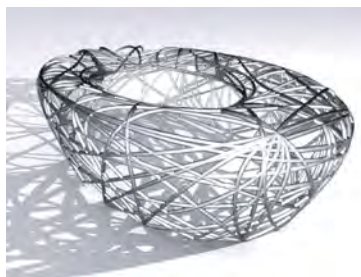


Surface refinements



Surface Subdivisions

Grasshopper (visual program)  
definition for Beijing's Bird's Nest  
pattern generation



## COURSE RESOURCE

The course material will be on Canvas. Any subsequent reference to 'Canvas' refers to the course Canvas website.

The class will be **conducted entirely remotely** through Zoom. The meeting link will be announced in Canvas. Links for each class in this course are provided in the Syllabus section on Canvas.

'Jump to Today' tab in the section will help find the class link. Please refer to the section below on Using Zoom.

## COURSE REQUIREMENTS

Laptop with Rhino/Grasshopper installed, or access to a CMUQ computer cluster with Rhino/Grasshopper installed.

## GRADING

Grades are based on **two** equally weighted assignments given half-way and at the end of the workshop. Grades are based on the following scheme:

**A:** 90% and over    **B:** 80-89%    **C:** 70-79%    **D:** 60-69%    **R:** < 60%

Students are not graded on a curve.

All assignments should be submitted on Canvas.

## POLICIES

All university academic and student policies as set out in <https://www.cmu.edu/policies/student-and-student-life/index.html> apply to this course.

Specifically:

- You are expected to be on time at all lectures (remotely).
- Email should only be used for crucial queries and concerns. Please direct course-related questions to me.
- In necessary circumstances where you are unable to attend class, please make sure to inform me via email and I will address the situation accordingly.

## REMOTE INSTRUCTION

This semester involves the regular use of technology during class. Research has shown that divided attention is detrimental to learning, so I encourage you to close any windows not directly related to what we are doing while you are in class. Please turn off your phone notifications and limit other likely sources of technology disruption, so you can fully engage with the material, each other, and me. This will create a better learning environment for everyone.

## USE OF ZOOM IN THE CLASS (INCLUDING USE OF VIDEO)

In our class, we will be using Zoom for synchronous (same time) sessions. See the Zoom link on Canvas. Please make sure that your Internet connection and equipment are set up to use Zoom and able to share audio and video during class meetings.

(See <https://www.cmu.edu/computing/start/students.html> for information on the technology you are likely to need.) Let IT at CMU-Q know, as early as possible, if there is an issue with your technology set-up to sort it out.

**SHARING VIDEO:** In this course, being able to see one another helps to facilitate a better learning environment and promote more engaging discussions. The default is to expect students to have their cameras on during lectures and discussions. However, I also completely understand that there may be reasons students would not want to have their cameras on.

**Note:** You may use a background image (preferably static image) in your video if you wish; just check in advance that this works with your device(s) and internet bandwidth.

- During our class meetings, please keep your mic muted unless you are sharing with the class or your breakout group.
- If you have a question or want to answer a question, please use the chat or the “raise hand” feature (available when the participant list is pulled up). I will monitor these channels to call on students to contribute.
- Our synchronous meetings may involve breakout room discussions, and those will work better if everyone in your small group has their camera turned on. During large group debriefs, you may keep your video off.

## RECORDING OF CLASS SESSIONS

All synchronous classes will be recorded via Zoom so that students in this course (and only students in this course) can watch or re-watch past class sessions. Please note that breakout rooms will not be recorded. However, chats are recorded. We do not encourage private chats during recorded Zoom sessions, instead, we recommend that you send us emails. We will make the recordings available on Canvas as soon as reasonably possible after each class session. Recordings will live on Canvas. Please note that you are not allowed to share these recordings. **This is to protect your FERPA rights and those of your fellow students.**

## RESPECT FOR DIVERSITY

It is my intention that all students irrespective of background or perspective continue to be well served by this course, that students’ learning needs are addressed both in and out of class, and that the diversity that you bring to this class be viewed as a resource, strength, and benefit. I intend to present materials and activities that are respectful of diversity in all its forms. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. Moreover, should any of our class meetings conflict with religious events, please let me know so that we can make suitable alternate arrangements for you.

## ACCOMMODATION FOR STUDENTS WITH DISABILITY

If you have a disability and are registered with the Office of Disability Resources, I encourage you to use their online system to notify me of your accommodations and discuss your needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at [access@andrew.cmu.edu](mailto:access@andrew.cmu.edu).

If you wish to be a volunteer note taker, please let me know. Should this course have students who need the assistance of a notetaker, I will direct you to contact Catherine Getchell ([getchell@cmu.edu](mailto:getchell@cmu.edu)) in the Office of Disability Resources on how to sign up as a notetaker.

## STUDENT WELL-BEING AND SUPPORT

Carnegie Mellon University is deeply committed to creating a healthy and safe campus community including one that is free from all forms of sexual and relationship violence. To that end, University Health Services, the Office of Community Standards & Integrity, and the Office of Title IX Initiatives have partnered to expand their educational efforts for graduate students in this domain. There is an educational opportunity for all graduate students at Carnegie Mellon that reflects its commitment to sexual assault and relationship violence prevention as well as to your overall safety:

It is important to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs, getting enough sleep, and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. There are many helpful resources available to all students on campus. Asking for support sooner rather than later is more often helpful. If you or anyone you know is experiencing academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Seek Counseling Services on campus here to help. Consider reaching out to a friend, faculty, or family member you trust for help getting connected to the support that can help.

## COURSE SCHEDULE\*

\* Schedule subject to change

Week	Lecture & computer instruction	Assignment
1 Introduction 03/22/21	course presentation introduction to parametric modeling	
2 Point and lines 03/24/21	coordinate systems • points, vectors + planes • polylines generated by functions and interpolation • transformation	
3 Curves 03/29/21	curves and transformations	Assignment 1 out
4 Surfaces 1 03/31/21	surfaces and traditional constructions	
5 Surfaces 2 04/05/21	surface and surface components (subsurface)	
6 Deformation 04/07/21	deformations and morphing	Assignment 2 out