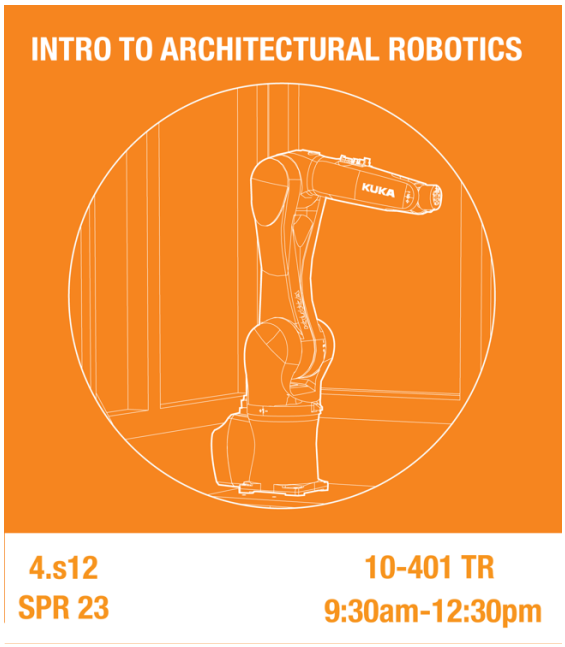
MIT Architecture

4.s12 Spring 2023
Intro to Architectural Robotics Workshop
Level: UG/G **Units**: 3-0-6 **Prerequisites**: None
Instructor(s): Myles Sampson
Schedule: 9:30 - 12:30 R in 10.401
Instructor: Myles Sampson, msamp@mit.edu



Description
Though industrial robotic arms are established tools for automotive and engineering practices, they are an emerging discipline in the field of architecture and design. Academic research labs and explorative design practices have demonstrated the power of robotic fabrication for mass customized design and construction. Still, there is a high barrier to entry to the computational methods used to control these machines. Understanding the fundamentals of robotic programming is key to unlocking the potential applications of robotics in architecture and design. This workshop is an introduction to the MIT Department of Architecture robotic arm through parametric design and digitally fabricated materials. Will we explore architectural robotics a series of short projects that introduce users to the basic operations of the machine.

Course Structure:

The Course will be structured into three topics as a means to explore a productive understanding architectural robotics.

Part 1/ Design Thinking: How do we communicate design intent to automated machines?

Part 2/ Design Materials: How can materials assist machine and human interactions?

Part 3/ Design Decisions: How can designers control machine actions for design production?

Learning Objectives/Pedagogy:
The course consists of four assignments and a final project to introduce students to parametric design, digital fabrication, and architectural robotics. Robotic programming, control, and manipulation will all be discussed from the perspective of a designer. Students should be able to engage with the course with an increasing level of design research through iterative prototypes and move fluidly between different modes and scales of operation. Each assignment builds on skillsets learned in previous exercises, and students are expected to document their design and fabrication process through drawings, models, photography, and time-based media. The final project allows students to combine the knowledge presented in the workshop to illustrate an understanding of the machine.

Absence Policy

Please work out any absences or issues with handing in assignments ahead of time, and they will be fine within reason. One unannounced absence and one late project will not affect your grade; more will.

Evaluation Criteria, Completion Requirements & Grading
All students are expected to attend all synchronous classes and participate in presentation updates, final presentations and discussion of presented work. If attending the synchronous class is not possible, please contact the instructor beforehand to plan an alternative arrangement. Regular attendance of synchronous weekly sessions is crucial for design development and live project discussions. The following criteria will be used for the evaluation of student's work, both in terms of helping their progress and in final grading:1) Thesis: How clearly is the student articulating the conceptual intentions? (02) Translation of Thesis: How well is the student using their thesis to develop a design response to given problems? (03) Representation Appropriateness: How well matched is their choice of representational means to their intentions? (04) Prototyping Quality: How accomplished are they with drawing, modeling, digital representation, and prototyping? (05) Oral Presentation Skills: How clearly are they presenting their ideas orally, whether at their desk, in class discussions, or to a more formal jury? (06) Participation in Discussions: How actively and how constructively are they involved in class discussions, both formally and informally? (07) Response to Criticism: How do they effectively take advantage of criticism from instructors, classmates and outside jurors? (08) Auto-Critical Skills: To what extent are they able to critique their own work regularly and effectively? (09) Attendance – attendance to all classes is mandatory, please email beforehand for an excused absence. (10) Group work – contributing to the group dynamic and willingness to collaborate. Attendance – attendance to all classes is mandatory, please email beforehand for excused absence.

Completion requirements:
Completion of each of the assignments, rigor in process and clarity in representation, as well as the overall progress of the semester (including attendance) will be fundamental to completing the course.

Grading Definition
Attendance 5%
Project 1: 15%
Project 2: 15%
Project 3: 15%
Project 4: 15%
Project 5: 15%
Final Project: 20%

Textbooks / Materials
Windows 10 or Higher
Rhino 7 + Grasshopper

Diversity
Diversity MIT values an inclusive environment. I hope to foster a sense of community in this classroom and consider this classroom to be a place where you will be treated with respect. I welcome individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class. If this standard is not being upheld, please feel free to speak with me.

Lab Fees
None.

Academic Integrity/Honesty
Massachusetts Institute of Technology students are here because of their demonstrated intellectual ability and because of their potential to make a significant contribution to human thought and knowledge. At MIT, students will be given unusual opportunities to do research and undertake scholarship that will advance knowledge in different fields of study. Students will also face many challenges. It is important for MIT students to become familiar with the Institute's policies regarding academic integrity, which is available at *Academic Integrity at MIT: A Handbook for Students.*

Course Calendar and Schedule

Week	Date	Content
Part 1		***Design Thinking***
Week 1	2/9	Course Introduction Shop Training
Week 2	2/16	**Assignment 1 – Introduction** Introduction to Drawing Machines Robotic Drawing Workshop
Week 3	2/23	**Assignment 1 - Presentation** Robotic Extrusion Lecture **Assignment 2 - Introduction**
Part 2		***Design Materiality***
Week 4	3/2	Extrusion Tutorial Guest Lecture
Week 5	3/9	**Assignment 2 – Presentation** **Assignment 3 - Introduction** Pick-and-Place Lecture Pick-and-Place Workshop
Week 6	3/16	Work Session/ Desk Crits
Week 7	3/23	**Assignment 3 – Presentation** Robotic Bending and End-Effector Design Lecture **Assignment 4 - Introduction**
	3/30	Spring Break – No Class
Part 3		***Design Decisions***
Week 8	4/6	Work Session/ Desk Crits
Week 9	4/13	**Assignment 4 – Presentation** Robotic Milling and Stereotomy Lecture **Final Project - Introduction**
Week 10	4/20	Work Session/ Desk Crits
Week 11	5/4	Work Session/ Desk Crits
Week 12	5/11	Work Session/ Desk Crits
Week 13	**5/18**	**Final Presentation**