

ZAIN KARSAN

Doctoral Candidate at CEA & DBT, ETH

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EDUCATION

September 2023 - Present	Eidgenössische Technische Hochschule Zürich, Doctoral Candidate Chair of Circular Engineering and Architecture & Chair of Digital Building Technologies Zurich, Switzerland
September 2021 - May 2023	Massachusetts Institute of Technology, Master of Science in Architectural Computation SMArchs Master of Science in Mechanical Engineering SM MEng Cambridge, Massachusetts, United States
September 2014 - February 2018	Massachusetts Institute of Technology, School of Architecture + Planning, Master of Architecture Cambridge, Massachusetts, United States
September 2009 - 2014	University of Waterloo, Faculty of Engineering, Bachelor of Architectural Studies Honors, Co-op Program Cambridge, Ontario, Canada 4A Semester in University of Waterloo Rome Studio (Fall 2013) Rome, Italy
September 2005 - June 2009	Turner Fenton Secondary School, International Baccalaureate Program Honors, Brampton, Ontario, Canada

TECHNICAL SKILLS

CAD,	-Revit Architecture, Autocad, Rhinoceros 3D, Houdini, Sketchup, Blender
VISUALIZATION,	-Eagle, KiCAD
ANALYSIS,	-Solidworks, ANSYS, Matlab
DOCUMENTATION	-Grasshopper, C#, Python, Java, C++ -Karamba, TKinter, Pytorch, Tensorflow, Numpy, Scipy, Matplotlib -Adobe Suite : Illustrator, Photoshop, Indesign, Premiere, After Effects -Microsoft Office
CAM , FABRICATION	Prototrak Knee Mill, Lathe, Onsrud Large Format Router, Kuka Industrial Arm Conversational Programming, Manual Machining, CNC Programming Stratasys ABS, 3D Systems ZCORP, FDM Printers: Prussa, Ultimaker, Makerbot, 3D WOX Fablight Metal Laser Cutting, WaterJet OMAX -Robot Master -KRL Coding -Mastercam -Autodesk Powermill & Robotic Simulation Plugin -Sum3d & Robomove -OMAX Layout and Make

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PUBLICATIONS

- 2023 Karsan Zain, K. Kaiser, J. Laucks, S. Tibbits, "Liquid Metal Printing," ACADIA 2023: Habits of the Anthropocene; proceedings of the 43rd annual conference of the Association for Computer Aided Design in Architecture, ACADIA, Colorado 2023.
- Karsan Zain, "Desk Mate: A Collaborative Drawing Platform," CAADRIA 2023: Human Centric; proceedings of the 28th CAADRIA conference, Ahmedabad 2023.
- 2021 Karsan Zain, "TinyZ: A Desktop CNC Machine to Enable Remote Digital Fabrication," ACADIA 2021: Realignments; proceeding of the 41st annual conference of the Association for Computer Aided Design in Architecture, ACADIA, Virtual 2021.
- Karsan Zain, "IN HOUSE: A Remote Making Studio" ACADIA 2021: Realignments; proceeding of the 41st annual conference of the Association for Computer Aided Design in Architecture, ACADIA, Virtual 2021.
- P. Gordiichuk, S. Coleman, G. Zhang, M. Kuehne, T.T.S. Lew, M. Park, J. Cui, A. M. Brooks, K. Hudson, A.M. Graziano, D.J.M. Marshall, Z. Karsan, S. Kennedy, M. S. Strano. "Augmenting the Living Plant Mesophyll into a Photonic Capacitor." Science Advances 7(37) 10.1126, 2021.
- 2020 Wang X., Tam K.M.M., Beaudouin-Mackay A., Hoyle B., Mason M., Guo Z., Gao W., Li C., Zhu W., Karsan Z., Kao G.T.C., Zhang L., Chai H., Yuan P.F. and Block P.3D-Printed Bending-Active Formwork for Shell Structures,Architectural Intelligence: Selected Papers from the 1st International Conference on Computational Design and Robotic Fabrication (CDRF 2019),Yuan, P.F., Xie, Y.M.M., Leach, N., Yao, J. and Wang, X. (editors),Springer Singapore,2020.
- 2019 Wang X., Kam K.-M. M., Földesi D., Lee H, Seo J., Vasileiou A., Luo Y., So C., Zhang X., Karsan Z., Kao G., Zhang L., Chai H., Yuan P. F. and Block P.High-performance corrugated concrete shell construction on bending-actuated robotically 3D-printed formwork,Proceedings of the IASS Symposium 2019,Barcelona,2019.
- Wang X., Tam K.-M. M., Beaudouin-Mackay A., Hoyle B., Mason M., Guo Z., Gao W., Li C., Zhu W., Karsan Z., Kao G., Zhang L., Chai H., Yuan P. F. and Block P.Tile-vault construction on bending-actuated robotically 3D-printed formwork,Proceedings of the IASS Symposium 2019,Barcelona,2019.
- 2017 Staback D., Nguyen M., Addison J., Angles Z., Karsan Z., Tibbits S., "Aerial Pop-Up Structures," ACADIA 2017: Disciplines and Disruption; proceeding of the 37th annual conference of the Association for Computer Aided Design in Architecture, ACADIA, Cambridge 2017.

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AWARDS, ACHIEVEMENTS, EXHIBITIONS

- September 2021 ACADIA 2021: "TinyZ: A Desktop CNC Machine to Enable Remote Digital Fabrication"
-Vanguard Award
- October 2020 City of Murmansk Urban Coziness Park Design
-Honourable Mention
- August 2020 Sudbury 2050 Urban Design Competition
-Honourable Mention
- June 2018 Post Graduate Teaching Fellowship
-MIT School of Architecture
- April 2018 Rotch Design Award
-MIT School of Architecture
- Summer 2017 Quarra Matter Fellowship
-Quarra Stone Company & Matter Design
- Fall 2016 Fast Cheap and Out of the Box
-MIT Museum Exhibition, ACADIA, AUTODESK BUILD Space
- Summer 2016 China Design Build Competition in collaboration with Wang Shu
- Winning Proposal, Zheizhang Province
- Summer 2015 Grove in collaboration with GLD
- Rose Kennedy Greenway
- Summer 2015 BUST in collaboration with WOJR
- Jai & Jai Gallery
- September 2015, 2016, 2017 MIT Graduate Merit Scholarship
-Full Tuition Award
- September 2014 MIT Graduate Fellowship
-Admission Scholarship
- August 2014 Project Review Exhibition
at Cambridge Riverside Gallery
- December 2013 Rome Program Exhibition
at Piazza di Santa Maria in Trastevere
- December 2012 Project Review Exhibition
at Cambridge Riverside Gallery
- October 2012 Work exhibited at University of Waterloo Open House
- June 2010 Featured in LAGI Competition Publication and
at the DIFC Public Exhibit in Dubai for "Infinity"
- Fall 2009 University of Waterloo President's Scholarship

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TEACHING EXPERIENCE

- Spring 2021 Graduate Option Studio Coordinator: IN HOUSE Remote Making Studio
This studio was an extended exercise in developing an architectural intervention wherever and however students were situated during the pandemic, with recourse to a distributed rapid prototyping tool. Each participant was provided a modular desktop milling machine, called the TinyZ, that is extendable and hackable.
- January 2021 Remote Making Fabrication Workshop
This workshop is designed to communicate fundamental concepts of machine building and CNC workflow to enable students to move fluidly between digital designs and physical material. Over the course of two weeks, students received kits with which to produce a desktop CNC Machine with a work area of roughly 6" x 6" x 4".
- Fall, Spring 2020 Graduate Level Workshop: Introduction to Robotic Fabrication
This course was developed and taught through a series of lectures and practical lab sessions that covered robotic programming and path planning, industrial automation, precision machining, and design of custom robotic tooling that integrated sensors and actuators. A series of projects were developed through the course that investigated novel material processes and experimental workflows.
- Spring 2020 Undergraduate Studio: How to Design
Introduces fundamental design principles as a way to demystify design and provide a basic introduction to all aspects of the process. Stimulates creativity, abstract thinking, representation, iteration, and design development. Equips students with skills to have more effective communication with designers, and develops their ability to apply the foundations of design to any discipline.
- Fall 2019 Undergraduate Studio: Introduction to Design Techniques and Technologies
Introduces the tools, techniques and technologies of design across a range of projects in a studio environment. Explores concepts related to form, function, materials, tools, and physical environments through project-based exercises. Develops familiarity with design process, critical observation, and the translation of design concepts into digital and physical reality.
- Fall 2019 - 2021 Graduate Course: How to Make (Almost) Anything
Provides a practical hands-on introduction to digital fabrication, including CAD/CAM/CAE, NC machining, 3-D printing and scanning, molding and casting, composites, laser and waterjet cutting, PCB design and fabrication; sensors and actuators; mixed-signal instrumentation, embedded processing, and wired and wireless communications.

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PROFESSIONAL EXPERIENCE

- September 2021 - Present Self Assembly Lab Research Associate
Primary researcher developing Liquid Metal Printing alongside industry partners AMADA and AISIN. This research involves designing, fabricating, and testing experimental machines to control the heating and deposition of molten aluminum in additive manufacturing. Additionally, simulations in Matlab and Solidworks are developed to refine process parameters.
- June 2018 - September 2021 MIT Teaching Fellow and Research Associate
As teaching staff and technical instructor at MIT, my role involved introducing students to design and fabrication methods, through hands on design studios and workshops, in addition to providing fabrication support to the school, and developing workflows to build complex projects using CNC machines of various kinds and with different materials.
- September 2019 - April 2020 Introduction to Robotic Fabrication - MIT
This course was developed and taught through a series of lectures and practical lab sessions that covered robotic programming and path planning, industrial automation, precision machining, and design of custom robotic tooling that integrated sensors and actuators. A series of projects were developed through the course that investigated novel material processes and experimental workflows.
- January - August 2017 Bose Fellowship KVA and Michael Strano
The research for this fellowship speculated on plant based lighting infrastructure based on close collaboration with PhD researchers at Michael Strano's Biotechnology lab. Extensive research in botany and plant morphology was undertaken to find suitable plant species that could be experimented with, coupled with architectural and building applications that would support and partner with selected plants. Work culminated in exhibition planning at the Cooper Hewitt and Cube Design Museum as part of the Design Triennale held by the Smithsonian.
- May - August 2017 MIT University of Michigan Quarra Matter Fellowship
This fellowship was formed to develop new fabrication workflows in robotic stone fabrication at the leading company in the field, Quarra Stone, involving the ability to rapidly learn the trade, tools, and existing CAD/CAM workflows in order to expand and develop new strategies for fabrication. The work culminated in the construction of a horizontally spanning stone and steel canopy. This design involved the coordination of complex steel and stone elements.
- January 2017 Cartagena Urban Planning Workshop
The workshop involved the design and presentation to locals and government officials of a novel low cost housing strategy to support displaced communities in Cartagena's peri-urban sites. The work involved travel, onsite documentation and interviews, and a synthesis of traditional forms of urbanism parsed from the historic center, to inform strategies for Cartagena's urban development and residential growth.

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- August 2016 MIT SEU CAA Village Design Competition
This competition with teams comprised of students from 3 different schools focused on the design of a public space and wash house to support the civic character and development of a remote village in China. Our team won the competition due in part to a focus on transforming and updating local craft and material methods and a sensitivity to the character of the village. The team developed a construction set and the design was constructed.
- June - August 2016 Universidad Adolfo Ibanez de Chile (Researcher & Teaching Assistant)
The work at UAI in Chile was divided in two roles, a research component involving the design and fabrication of an end effector for multi material extrusion, and a teaching assistantship to support students in their penultimate year of undergraduate studies in design. Both roles depended on the ability to work across languages by communicating graphically, especially in studio environments. The research work demanded a rapid technical immersion to fabricate.
- January 2016 MIT SEU Nanjing Urban Planning Workshop
A month long collaboration with students from South East University to develop planning guides for the reimagination of the Nanjing countryside. The work involved site visits and interviews, as well as a comprehensive analysis of existing conditions and a design response at regional and local scales. I helped produce and shape the design response and guide the analysis, managing students from SEU to complete a coherent planning guide.
- January 2016 KVA (Intern Architect)
The work involved the design of a center for deaf education, which revolved around considerations for deaf culture and communication. The project was in the second stages of a design competition where an initial idea was developed to a schematic design level. A series of charrettes for the design of a Deaf-friendly Facade and accompanying pavilions exhibiting deaf culture were the main focus of the work.
- July - August 2015 WOJR (Researcher)
The research position involved material studies and fabrication experiments to produce a sculpture for an exhibition held in Los Angeles. Material logics were explored in service of a thematic concern.
- May-July 2015 GLD Architects (Researcher)
The work involved the production of an installation at the Greenway Park in Boston. Research revolved around composite manufacturing with inflatable molds. The process underwent several iterations at small scale before the a series of 12 large scale fibreglass parts were produced for the final installation. The refinement of onsite construction was also of critical concern.
- January - April 2014 Montgomery Sisam (Student Architect)
At Montgomery Sisam, I worked on two institutional projects, both schools in Toronto, a renovation and addition of an existing school, and a building for the University of Toronto. Both projects were developed from a design development phase to the construction document phase, where updating and creating detailed drawings were typical exercises.

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- January - August 2013 NBBJ (Student Architect)
At NBBJ, I worked closely with the head of design to develop physical models and design studies for charrettes and presentations. Much of the work was conceptual and schematic specifically on two projects, a residential complex in Chengdu, and a hospital in Shanghai. Both projects were developed from a conceptual level to a schematic level through a series of physical modeling studies in varied materials.
- May - August 2012 Diamond and Schmitt Architects (Student Architect)
At Diamond and Schmitt, I worked on two educational projects at the construction documentation stage, both developed in Revit. Throughout the term, I worked on refining the Revit models and producing detail drawings and packages for Tender and Costing. I worked very closely with the project captains to develop interior details and design options.
- April 2012 Univeristy of Waterloo School of Architecture
Revit Architecture and Parametric Design Workshop
After a work term at KPF, and a studio focused on urban design, I proposed to the school, a workshop in which I would teach at an introductory level, Revit and Advanced Parametric Design with Adaptive Components. I prepared an outline and held workshop covering basic tools in Revit and advanced concepts in Family construction.
- September - December 2011 Kohn Pedersen Fox Associates (Architecture Intern)
At Kohn Pedersen Fox I worked on three large mixed use projects, at construction documentation, schematic design, and design development stages. I worked on Revit projects for the majority of my time at KPF, preparing design options and coordination drawings for design meetings with consultants and clients, as well as refining the Revit models for presentation in meetings. I worked very closely with the project captains in each team to design solutions to changes in structural and mechanical drawings.
- January - April 2011 WZMH Architects (Design Assistant)
While at WZMH I worked on a large scale project for a government agency. Much of the work was done in Revit Architecture to produce working and schematic design drawings for Progress, Tender and Addenda. I worked very closely with the senior designers, technicians, BIM managers, and Structural, Civil, Landscape, Mechanical, and Electrical Consultants on the project to create parametric families to adapt to design and coordination changes, as well as a model in Rhino for 3D print.
- July - August 2010 JCI Architects (Architecture Intern)
During my period of internship at JCI, I worked on a series of residential projects in their design development and schematic design phases. I worked closely with the partners to develop their ideas and parti sketches to detailed 3D models in Rhino and Sketchup, creating various design options in the process. I used Adobe Suite extensively as much of my work involved preparing drawings for client presentations.