Keith J. Lee / Curriculum Vitæ

RESEARCH INTERESTS

High-performance computing in structural design; low-carbon structural systems; constructability and complexity; circular structural design.

ACADEMIC APPOINTMENTS

Massachusetts Institute of Technology, Cambridge USA

Postdoctoral Associate — 2026-PRESENT
Department of Civil and Environmental Engineering
Advisor: Caitlin T. Mueller

Lecturer — 2025
Department of Architecture
4.463 Building Technology Systems: Structures and Envelopes

PROFESSIONAL

Forma Systems, Cambridge USA
Head of Structural Design and Computation — 2025-PRESENT

JJJJound, Montréal Canada
Design Consultant: B/02 Bicycle — 2019-2020

BA Blacktop, North Vancouver Canada
Subsurface Grader — 2012-2013,2014

EDUCATION

MIT
Department of Architecture

Doctor of Philosophy in Architecture: Building Technology — 2025
- Dissertation: *Geometric interpretations of structural demand for the analysis and reduction of design complexity*
- Advisor: Caitlin T. Mueller

McGill University, Montréal Canada
Department of Civil Engineering and Applied Mechanics

Master of Engineering — 2020
- Thesis: *Moment-induced block shear failure in bolted flange plate connections*
- Advisor: Colin Rogers

Bachelor of Engineering — 2018

TEACHING

MIT
Department of Architecture

Instructor
- 4.463 Building Technology Systems: Structures and Envelopes — 2025
  with H. Samuelson
- 4.181 OFFCUT/CUTOFF — 2025
  with L. Alkhayat and M. Aljomairi. Sitra, Bahrain.
- 4.181 Digital Circularity: Tooling up for reuse with Odds & Mods — 2024
  with R.M. Blowes, C. Chaussabel, A.H. Kyaw, K-J Sørensen and C.T. Mueller
- 4.S44 In Tension: The computational design, engineering, and fabrication of large scale sculptural rope networks — 2023
  with A. Beghini, A. Burke, J. Echelman, C.T. Mueller and N. Wang

Teaching Assistant

- 4.462 Introduction to Structural Design 2021, 2025
  Instructor: J. Ochsendorf
- 4.450 Computational Structural Design and Optimization 2022, 2024
  Instructor: C.T. Mueller
- 4.463 Building Technology Systems: Structures and Envelopes 2021, 2023
  Instructor: C.T. Mueller

McGill
Department of Civil Engineering and Applied Mechanics
Teaching Assistant

- CIVE318 Structural Engineering II 2019, 2020
  Instructor: C. Rogers
- CIVE385 Structural Steel and Timber Design 2018, 2019
  Instructors: A. Mofidi (2018), S. Kamel (2019)

PEER-REVIEWED PUBLICATIONS

Lee, K.J. and Mueller, C.T. "Demand Space Analysis: Variational interpretation of structural demand for complexity-aware design" *Automation in Construction* (in preparation) 2026.

Lee, K.J., Mueller, C.T. and Huang, Y. "Differentiable assignment for circularity-driven structural design and optimization" *Structures* (in preparation) 2026.

Donovan, I., Schnitzler, J., Cañada, J. and **Lee, K.J.** "Experimental investigation of a modular precast concrete beam system for demountable structures" *International Association of Shell and Spatial Structures Annual Conference* (in preparation) 2026.

Nathansohn, N., **Lee, K.J.**, Tibbits, S. and Mueller, C.T. "Reviving Icelandic vernacular: Computational optimization of raw basalt stone arches" *CAADRIA* 2026.

Hong, C.S.H., **Lee, K.J.** and Mueller, C.T. "Reinforcement learning for generative structural design: Optimizing truss-based cantilever structures without predefined topologies" *International Association of Shell and Spatial Structures Annual Conference* 2025.

Fontaine, A., Moldow, O.I., Blowes, R.M., **Lee, K.J.**, Sørensen, K-J and Mueller, C.T. "Stock-constrained design of pseudo-standard walls from stud offcuts" *International Association of Shell and Spatial Structures Annual Conference* 2025.

Lee, K.J., Huang, Y., Mueller, C.T. "A differentiable structural analysis framework for high performance design optimization" *Structures* 2025.

Blowes, R.M., **Lee, K.J.**, Mayencourt, P., Kennedy, S. and Mueller, C.T. "A digital circularity approach to leverage waste lumber in dowel-laminated timber slabs" *International Conference on Structures and Architecture* 2024.

Alkhayat, L., **Lee, K.J.** and Mueller, C.T. "The Crown Jewels: Algorithmic design of rubble trusses for the Arabian Peninsula" *ACADIA* 2024.

Curth, A., Pearl, N., Wissemann, E., Cousin, T., Alkhayat, L., Jackow, V., **Lee, K.J.**, Moldow, O.I., Ismail, M.A., Mueller, C.T. and Sass, L. "EarthWorks: Zero waste 3D printed earthen formwork for efficient reinforced concrete construction" *Construction & Building Materials* 2024.

Lee, K.J., Hirt, N.K. and Mueller, C.T. "Geometry, strength, and efficiency: Tracing the standardization of North American structural steel, 1888-present" *8th International Congress on Construction History* 2024.

Donovan, I., Schnitzler, J., **Lee, K.J.**, Wongsittikan, P., Liu, E. and Mueller, C.T. "Pixelframe: A reconfigurable, precast, post-tensioned concrete structural system for a circular building economy" *International scientific conference on the Built Environment in Transition* 2023.

Burke, A., **Lee, K.J.**, Echelman, J., Feldman, D. and Mueller, C.T. “FDMremote: Interactive inverse design of tensile structures with differentiable FDM” *International Association of Shell and Spatial Structures Annual Conference* 2023.

Lee, K.J., Danhaive, R. and Mueller, C.T. “Spherical harmonic shape descriptors of nodal force demands for quantifying spatial truss connection complexity” *Architecture, Structures and Construction* 2022.

Lee, K.J. and Mueller, C.T. “Adapting computational protein folding logic for growth-based, assembly driven spatial truss design” *International Association of Shell and Spatial Structures Annual Conference* 2021.

OTHER PUBLICATIONS

Lee, K.J., Titova, A., Mueller, C.T. and Ochsendorf, J. “Achieving next-generation transportation infrastructure through lifecycle performance assessment, design excellence, and digital fabrication” *MIT Policy perspectives on infrastructure* 2021.

Lee, K.J. “Influence and compromise in post-war Korean architecture” *MIT Architecture: Imprint 02* 2021.

APPLIED RESEARCH & DESIGN

Pixelframe — 2022-PRESENT
Reconfigurable pre-stressed concrete systems.
with I. Donovan, J. Schnitzler, P. Wongsittikan and C.T. Mueller.
Supported by Holcim and the MIT Climate and Sustainability Consortium

Octahedral-Tetrahedral Spaceframes — 2022-PRESENT
Reconfigurable spatial truss system design with reused scaffolding struts.
with J. Arul.

Programmable Mud — 2023-2025
Low-carbon earthen construction.
with E. Gascón Alvarez, A. Curth, and C.T. Mueller.
Under construction.

Digital Circularity/Odds & Mods — 2023-2025
Computational approaches to circular structural design.
with R.M. Blowes, C. Chaussabel, A.H. Kyaw, K-J Sørensen and C.T. Mueller.

Make/Shift: Algorithmic design for a circular material future — 2023
Zero-waste timber offcut design. Competition finalist.
with J. Berglund-Brown, I. Donovan, K. Feickert, J. Schnitzler and C.T. Mueller

COMPUTATIONAL DESIGN TOOLS

DigitalCircularityToolkit — 2023-PRESENT
Grasshopper plugin for circular design.

Asap.jl/AsapOptim.jl — 2021-PRESENT
Structural analysis and gradient-based optimization.

FDMremote — 2022-2023
Grasshopper plugin for inverse form-finding of equilibrium networks.

AWARDS

MIT
- MIT Research Support Committee Grant, $90,000 — 2025-2026
- Avalon Travel Award, $600 — 2022, 2024
- TODA Travel Award, $1,000 — 2022, 2024

McGill
- Graduate Excellence Award, $5,000CAD — 2019
- Engineering Undergraduate Student Master’s Award (MEUSMA), $15,000CAD — 2018-2019

- Hydro Québec Scholarship, $20,000CAD 2018-2019
- Greville Smith Scholarship, $40,000CAD 2013-2017

National Science and Engineering Research Council of Canada
- Alexander Graham Bell Scholarship - Master's (CGS-M), $35,000CAD 2019
- Undergraduate Summer Research Award (USRA), $7,000CAD 2016, 2018

Fonds de Recherche Québec Nature et Technologies
- Bourse de Recherche de Première Cycle (BRPC), $2,000CAD 2016, 2018

EXHIBITIONS

From Liquid to Stone: A reconfigurable concrete tectonic against obsolescence 2025
with I. Donovan, E. Liu, C.T. Mueller, J. Schnitzler and P. Wongsittikan. Venice Biennale.

Programmable Mud 2025
with A. Curth, E.G. Alvarez and C.T. Mueller. Venice Biennale.

INVITED REVIEWS

1.562 Structural Design Project I 2025
Instructor: Paul Richardson
MIT Civil and Environmental Engineering, Cambridge USA

GSD 01201 - Third Semester Core: Architectural Design 2025
Coordinator: Eric Höweler
Harvard Graduate School of Design, Cambridge USA

4.153 Architectural Design Core Studio III 2025
Coordinator: J. Yolande Daniels
MIT Architecture, Cambridge USA

4.462 Introduction to Structural Design 2022-2024
Instructor: J. Ochsendorf
MIT Architecture, Cambridge USA

4.463 Building Technology Systems: Structures and Envelopes 2021-2024
Instructor: C.T. Mueller
MIT Architecture, Cambridge USA

4.041 Advanced Product Design 2023
Instructor: Xavi L. Aguirre
MIT Architecture, Cambridge USA

ARCH 448 Structural Systems in Architecture II 2021
Instructor: Jonathan Dessi-Olive
Kansas State University, Manhattan USA

INVITED TALKS

The geometry of what we want and the shape of what we have 2026
University of Manitoba Faculty of Architecture, CAST Lecture Series, Winnipeg Canada

Computational Structural Optimization (two lectures) 2025
Stanford CEE 280: Advanced Structural Analysis, Stanford USA

Digital Circularity 2025
OFFCUT/CUTOFF, Muharraq Bahrain

The Crown Jewels: Algorithmic design of rubble trusses for the Arabian Peninsula 2024
ACADIA2024, Banff Canada

Digital Circularity: Algorithmic approaches to large-scale reuse 2024
Tecnólogico de Monterrey, Santiago de Querétaro Mexico

Structural analysis and optimization 2024
MIT 4.450 Computational Structural Design and Optimization, Cambridge USA

Differentiable assignment for circularity-driven structural design and optimization 2024
ACM SIGGRAPH Symposium on Geometry Processing, Cambridge USA

A differentiable assignment algorithm for high performance, inventory-driven structural design 2023
EPFL (in)visible reuse Research Symposium, Lausanne Switzerland

Structural Steel 2021-2024
MIT 4.463 Building Technology Systems: Structures and Envelopes, Cambridge USA

Introduction to the Finite Element Method 2022
MIT 4.450 Computational Structural Design and Optimization, Cambridge USA

Pixelframe: Concrete structures against obsolescence 2022
MIT Climate & Sustainability Consortium Symposium, Cambridge USA

Reducing embodied energy with novel building structures 2022
Groupe Bouygues - MIT Industrial Liason Program, Cambridge USA

The similarity of forces in equilibrium: A geometric approach 2022
Foster + Partners, London UK

Spherical harmonic shape descriptors of nodal force demands for quantifying spatial truss connection complexity 2022
5th International Conference on Structures & Architecture, Aalborg Denmark

Adapting computational protein folding logic for growth-based, assembly driven spatial truss design 2021
International Association of Shell and Spatial Structures Annual Conference, Surrey UK

Complexity & similarity in structural design 2021
MIT Architecture SMArchS Colloquium, Cambridge USA

ACADEMIC ADVISING

MIT

Thesis Reader

- Jenna Schnitzler (SM Building Technology) 2024
- Inge Donovan (SM Building Technology) 2024

Research Mentor

- Karl-Johan Sørensen (SMarchS Computation) 2023-2024
- Natasha Hirt (SM Building Technology) 2023-2024
- Jenna Schnitzler (MArch) 2022-2024
- Inge Donovan (MArch) 2022-2024
- Pitipat Wongsittikan (SM Building Technology) 2022-2024
- Jerome Arul (SM Engineering and Management) 2022-2023
- Adam Burke (SMArchS Building Technology) 2022
- Alena Titova (MArch) 2021

Undergraduate Research Opportunity Program (UROP)

- Yanjun (Emily) Liu 2022-2023
- Collin Wen 2022
- Azariah (Azu) Beyene 2022

McGill

Summer Undergraduate Research in Engineering (SURE)

- Leïlah Y.K. Sory 2020
- Jacob Burke 2019

- Mairvat Abdulhamid 2019

SERVICE

Admissions Committee 2024
MIT Architecture - Building Technology

Stride into STEM: Generative Structural Design 2022
Altair - Instructor

Engineering Independence: Concrete Architecture in the Global South 2021
MIT Architecture - Symposium Organizer

PATENTS

Pixelframe 2023
Reconfigurable precast concrete construction system for buildings designed through algorithmic engineering with inventory constraints
Serial No. 63/499,222
Provisional.

WORKFLOW

Languages
English (native), French (proficient), Korean (proficient)

Computation
- Programming: Julia, C#, Python, Matlab
- CAD: Rhinoceros3D/Grasshopper
- Engineering: Abaqus/CAE, Karamba3D
- Typesetting: LaTeX, Typst
- Design: Adobe Suite

Structural Laboratory/Construction
- Hydraulic actuators/controllers (MTS)
- Measurement: LVDTs, string potentiometers, strain gauges, DAQ systems (Strainsmart, MTS)
- General powered/non-powered construction equipment
- Qualifications (Canada): Construction safety, forklift operation, bridge crane operation, working at heights, WHMIS

REFERENCES

Caitlin T. Mueller (Associate Professor, MIT)
John Ochsendorf (Professor, MIT)
Sheila Kennedy (Professor, MIT)
Guy Nordenson (Professor, Princeton)
Colin Rogers (Professor, McGill)

Contact information available upon request.

LAST UPDATED: 2026-02-28
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