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Masoud Akbarzadeh

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Appointments

2017-	Assistant Professor Weitzman School of Design **University of Pennsylvania**
2021-	Affiliated Faculty GRASP Lab School of Engineering and Applied Science **University of Pennsylvania**
2012-16	Research & Teaching Assistant Institute of Technology in Architecture **ETH Zurich**
2008-12	Research & Teaching Assistant Department of Architecture **Massachusetts Institute of Technology**

Education

2016	**Doctor of Science** ETH Zurich ZURICH, SWITZERLAND
2012	**Master of Science** in Design Computation Massachusetts Institute of Technology CAMBRIDGE, MA, US
2011	**Master of Architecture** Massachusetts Institute of Technology CAMBRIDGE, MA, US
2007	**Master of Science** in Earthquake Engineering and Dynamics of Structures Iran University of Science and Technology TEHRAN, IRAN
2004	**Bachelor of Science** in Civil and Environmental Engineering Zanjan University ZANJAN, IRAN

Research Grants & Awards

2020	Co-PI in National Science Foundation Future of Manufacturing Grant (NSF-FM) $4,600,000 Title: *FMRG: Threading High-Performance, Self-Morphing Building Blocks Across Scales Toward a Sustainable Future*. CMMI Div. of Civil, Mechanical, & Manufact Inn. # 2037097
2020	National Science Foundation CAREER Award $599,722 Title: *3D/Polyhedral Graphic Statics for Education, Design, and Optimization of High-Performance Structures.* CMMI Div. of Civil, Mechanical, & Manufact Inn. # 1944691
2020	A'Design Award and Competition Silver A'Design Award for *Saltatur: The Dancer*
2019	University Research Foundation Grant $36,000 Title: *High-performance compression-only modular hollow glass Structures: innovative engineering and use of material for ultra-transparent long-span structures.*
2018	University Research Foundation Grant $49,495 Title: *Ultra Lightweight, High Performance Structural Elements: Innovative Design, Analysis, and Fabrication Using 3D Graphic Statics.*
2018	Penn Undergraduate Research Mentoring Program (PURM) $8,000
2012	Swiss Federal Institute of Technology ITA Fellowship Award for PhD studies

2011 SOM Traveling Fellowship for Architecture, Design, and Urban Design $20,000

Title: *Designed for Water: Infrastructures Taming the Water and Producing Energy.*

2010 Massachusetts Institute of Technology Show Case competition: First Prize

2008 Massachusetts Institute of Technology Merit-Based Scholarship

Declined Grant Applications

2020 NSF Partnerships for Innovation (PFI) $250,000

Title: *3D printing high-performance, spatial concrete for large-scale.*

2019 National Science Foundation $497,216

Title: *CAREER: The Innovative Design and Fabrication of Ultra-Lightweight, Efficient Structures Using Geometry-Based Structural Design Methods in 3D.*

2018 National Science Foundation $1,706,641

Title: *Three Dimensional Graphical Statics and Its Application in Design, Engineering, and Fabrication.*

Publications

Book Contracts

2020

M. Akbarzadeh. *Introduction to Polyhedral Graphic Statics and Design of Funicular Structures*. Cambridge University Press, Cambridge, 2022. *in preparation*

M. Akbarzadeh. *Funicular Polyhedral Structures: Design and Materialization*. Routledge, 2022. *in preparation*

Invited Book Chapters

2020

M. Akbarzadeh, T. Van Mele, and P. Block. Polyhedral Reciprocal Diagrams. In W. Baker, P. Block, C. Fivet, and J. Ochsendorf, editors, *J.C. Maxwell and the Geometry of Structures*. *in preparation*

Industry Sponsored Books

2015

M. Akbarzadeh. *Designed For Water: Infrastructures taming the water and producing energy*. SOM Foundation, 2015

Peer-Reviewed Journal Papers

2021 M. Akbari, A. Mirabolghasemi, M. Bolhassani, A. Akbarzadeh, and M. Akbarzadeh. Strut-based Cellular to Shellular Funicular Polyhedral Materials. *Advanced Functional Material*. *Submitted for review*

J. Yost, M. Akbarzadeh, M. Bolhassani, A.P. Chaddeh, and J. Schneider. Behavior of Modular Components in a Funicular Glass Bridge. *Engineering Structures*, 2021. *under review*.

M. Akbarzadeh and M. Hablicsek. Algberaic 3D graphic statics: Constrained Areas. *Computer-Aided Design*, 141, 2021

2020 S. Mozaffari, M. Akbarzadeh, and T. Vogel. Graphic statics in a continuum: strut-and-tie models for reinforced concrete. *Computers and Structures*, November 2020

A. Nejur and M. Akbarzadeh. PolyFrame: Efficient Computation for 3D Graphic Statics. *Computer-Aided Design Journal*, 134, 2020

H. Zheng, V. Moosavi, and M. Akbarzadeh. Iterative Machine Learning for Structural Form Finding with Fabrication constraints. *Automation in Construction*, November 2020

2018 Márton Hablicsek, Masoud Akbarzadeh, and Yi Guo. Algebraic 3D graphic statics: Reciprocal constructions. *Computer-Aided Design*, 108:30 – 41, 2019

2017 M Bolhassani, M Akbarzadeh, M. Mahnia, and R. Taherian. On Structural Behavior of a Funicular Concrete Polyhedral Frame Designed by 3D Graphic Statics. *Structures*, 14:56 – 68, 2018

2016 M. Akbarzadeh, T. Van Mele, and P. Block. Three-dimensional Graphic Statics: Initial explorations with polyhedral form and force diagrams. *International Journal of Space Structures*, 31(2):217–226, June - September 2016

2015 M. Akbarzadeh, T. Van Mele, and P. Block. On the equilibrium of funicular polyhedral frames and convex polyhedral force diagrams. *Computer-Aided Design*, 63:118–128, 2015

Peer-Reviewed Conference Papers

2021 Mathias Bernhard, Mohammad Bolhassani, and Masoud Akbarzadeh. Performative Porosity adaptive infills for concrete parts. In *Proceedings of the IASS Annual Symposium 2020/21*, Surrey, UK, 2021

Hua Chai and Masoud Akbarzadeh. Web-based Interactive Polyhedral Graphics Statics Platform. In *Proceedings of the IASS Annual Symposium 2020/21*, Surrey,UK, 2021

Y. Lu, M. Cregan, P.A. Chhadeh, A. Seyedahmadian, M. Bolhassani, J. Schneider, J.R. Yost, and M. Akbarzadeh. All glass, compression-dominant polyhedral bridge prototype: form-finding and fabrication. In *Proceedings of IASS Symposium and Spatial Structures Conference 2020/21, Inspiring the next generation*, Guildford, UK, August 23-27 2021

Hao Zheng, Marton Hablicsek, and Masoud Akbarzadeh. Lightweight Structures and the Geometric Equilibrium in Dragonfly Wings. In *Proceedings of International Association for Shell and Spatial Structures Annual Symposia (IASS)*, 2021

Hablicsek M. and M. Akbarzadeh. Designing the Geometry of Auxetic Materials using Graphic Statics. In *Proceedings of IASS Symposium and Spatial Structures Conference 2020/21, Inspiring the next generation*, Guildford, UK, August 23-27 2021

2020 M. Akbarzadeh, A. Tabatabaie Ghomi, M. Bolhassani, M. Akbari, A. Seyedahmadian, J. Sun, H. Yao, , J. Miziumski, and K. Papalexiou. Saltatur: Node-Based Assembly of Funicular Spatial Concrete. In *Proceedings of the 40th Annual Conference of the Association for Computer-Aided Design in Architecture (ACADIA)*, 2021

Hao Zheng, Xinyu Wang, Zehua Qi, Shixuan Sun, and Masoud Akbarzadeh. Generating and Optimizing a Funicular Arch Floor Structure. In *Proceedings of the 40th Annual Conference of the Association for Computer-Aided Design in Architecture (ACADIA)*, 2020

2019 M. Akbarzadeh and M. Hablicsek. Geometric Degrees of Freedom and Non-Conventional Spatial Structural Forms. In C. Gengnagel, O. Baverel, J. Burry, M.R. Thomsen, and S. Weinzierl, editors, *Impact: Design With All Senses: Proceedings of the Design Modelling Symposium*, Berlin, Germany, September 23-25 2020. Springer International Publishing

M. Akbarzadeh, M. Bolhassani, A. Nejur, J. R. Yost, C. Byrnes, J. Schneider, U. Knaack, and C. Borg Costanzi. The Design of an Ultra-Transparent Funicular Glass Structure. In *Structures Congress 2019*, Orlando, Florida, April 24-27 2019

S. Mozaffari, M. Akbarzadeh, and T. Vogel. Generation of strut-and-tie models and stress fields for structural concrete. In *Structures Congress 2019*, Orlando, Florida, April 24-27 2019

M. Akbari, M. Bolhassani, and M. Akbarzadeh. From Polyhedral to Minimal Surface Funicular Spatial Structures. In *Proceedings of IASS Symposium 2019 and Structural Membranes 2019, FORM and FORCE*, Barcelona, Spain, October 7-10 2019

2018 M. Akbarzadeh, M. Hablicsek, and Y. Guo. Developing Algebraic Constraints for Reciprocal Polyhedral Diagrams of 3D Graphic Statics. In *Proceedings of the IASS Symposium 2018, Creativity in Structural Design*, MIT, Boston, USA, July 16-20 2018

G. S. Athanasopoulos, M. Akbarzadeh, and A. McRobie. Graphic Statics: Constrained Form Finding for Parallel System of Forces Using Corsican Sum. In C. Mueller and S. Adriaenssens, editors, *Proceedings of the IASS Symposium 2018, Creativity in Structural Design*, MIT, Boston, USA, July 16-20 2018

A. Tabatabaei Ghomi, M. Bolhassan, A. Nejur, and M. Akbarzadeh. Effect of Subdivision of Force Diagrams on the Local Buckling, Load-Path and Material Use of Founded Forms. In C. Mueller and S. Adriaenssens, editors, *Proceedings of the IASS Symposium 2018, Creativity in Structural Design*, MIT, Boston, USA, July 16-20 2018

M. Bolhassan, A. Tabatabaei Ghomi, A. , and M. Akbarzadeh. Structural Behavior of a Cast-in-Place Funicular Polyhedral Concrete: Applied 3D Graphic Statics. In C. Mueller and S. Adriaenssens, editors, *Proceedings of the IASS Symposium 2018, Creativity in Structural Design*, MIT, Boston, USA, July 16-20 2018

A. Nejur and M. Akbarzadeh. Constrained Manipulation of Polyhedral Systems. In *Proceedings of the IASS Symposium 2018, Creativity in Structural Design*, MIT, Boston, USA, July 16-20 2018

2017 Akbarzadeh Masoud, Mahnia Mehrad, Taherian Ramtin, and Tabrizi Amir Hossein. Hedracrete; Prefab, Funicular, Spatial Concrete. In *DISCIPLINES & DISRUPTION: Projects Catalog of the 37th Annual Conference of the Association for Computer Aided Design in Architecture (ACADIA)*. Association for Computer Aided Design in Architecture (ACADIA), 2017

M. Akbarzadeh, M. Mahnia, R. Taherian, and A. Tabrizi. Prefab, Concrete Polyhedral Frame: Materializing 3D Graphic Statics. In A. Bögle and M. Grohmann, editors, *Proceedings of the IASS Annual Symposium 2017, Interfaces: architecture . engineering . science*, Hamburg, Germany, September 25 - 28th 2017. IASS. Submitted for review

2017 T. H. Nielsen, M. Akbarzadeh, and P. Goltermann. Addressing buckling of compression members using subdivision of force diagrams. In A. Bögle and M. Grohmann, editors, *Proceedings of the IASS Annual Symposium 2017, Interfaces: architecture . engineering . science*, Hamburg, Germany, September 25 – 28th 2017. IASS. Submitted for review

2015 M. Akbarzadeh, T. Van Mele, and P. Block. Three-dimensional Compression Form Finding through Subdivision. In *Proceedings of the International Association for Shell and Spatial Structures (IASS) Symposium*, Amsterdam, The Netherlands, 2015

M. Akbarzadeh, T. Van Mele, and P. Block. 3D Graphic Statics: Geometric Construction of Global Equilibrium. In *Proceedings of the International Association for Shell and Spatial Structures (IASS) Symposium*, Amsterdam, The Netherlands, 2015

M. Akbarzadeh, T. Van Mele, and P. Block. Three-dimensional Compression Form Finding through Subdivision. In *Proceedings of the International Association for Shell and Spatial Structures (IASS) Symposium*, Amsterdam, The Netherlands, 2015

2014 D. Löpez Löpez, D. Veenendaal, M. Akbarzadeh, and P. Block. Prototype of an ultra-thin, concrete vaulted floor system. In *Proceedings of the IASS-SLTE 2014 Symposium*, Brasilia, Brazil, 2014

M. Akbarzadeh, T. Van Mele, and P. Block. Compression-only form finding through finite subdivision of the external force polygon. In *Proceedings of the IASS-SLTE 2014 Symposium*, Brasilia, Brazil, 2014

2013 M. Akbarzadeh, T. Van Mele, and P. Block. Equilibrium of spatial networks using 3D reciprocal diagrams. In J.B. Obrbski and R. Tarczewski, editors, *Proceedings of the International Association for Shell and Spatial Structures (IASS) Symposium 2013*, Wroclaw, Poland, September 2013

2012 M. Akbarzadeh. Performative Surfaces: Making Adaptive Tools to design Roofs and Landscapes based on Computational Interpretation of Flow Patterns. In *Association for Computer-Aided Design in Architecture 2013 International Conference: Adaptive Architecture*, Cambridge, Ontario, Canada, 2013

2011 M. Akbarzadeh. Robot arm. In S. Hirschman, editor, *Testing to Failure: Design and Research in MIT's Department of Architecture*. SA+P Press, 2011

2009 M. Akbarzadeh. Tensional integrity. In A. Miljacki, L. Pauli, and B. Pinney, M. Sleeper, editors, *Uncertain Futures, Two Years of Student Research at The MIT Department of Architecture*. SA+P Press, 2009

2007 M. Zahedi, G. Ghodrati Amiri, and M. Akbarzadeh. Characteristics of vertical spectrum of earthquake in nearfeild regions and its effects on the dynamic responses of bridges. In *4th International Conference on Earthquake Geotechnical Engineering, ICEGE*, Thessaloniki, Greece, June 25-28 2007

Theses & Dissertation

2016 M. Akbarzadeh. *3D Graphic Statics using Reciporcal Polyhedral Diagrams*. PhD thesis, ETH Zürich, Zürich, Switzerland, 2016

2012 M. Akbarzadeh. Designing performative surfaces: Computational interpretation of flow pattern drawings. Master's thesis, MIT, Cambridge, MA, US, 2012

2011 M. Akbarzadeh. Hydropower cities: A new candidate for future. Master's thesis, MIT, Cambridge, MA, US, 2012

Software Products

M Akbarzadeh and A Nejur. PolyFrame: Structural Form Finding Tool Using 3D Graphic Statics. `https://www.food4rhino.com/app/polyframe`, 2017–2019

Synergistic Activities

2022 Conference Co-Chair Association of Computer Aided Design in Architecture (ACADIA) **University of Pennsylvania, Philadelphia, PA, US**

2021 Competition Jury Terra x Terra - Pavilion Design Workshop + Competition

2021 - Editorial Board Architecture, Structures and Construction Journal **Springer**

2021 Scientific Committee International Association of Shell and Spatial Structures **University of Surrey**

2020 Session Co-Chair Association of Computer Aided Design in Architecture (ACADIA) **Distributed Porximities: Online Conference**

2020 Session Co-Chair American Society of Civil Engineers **Washington , D.C., US**

2020 Chair of Architectural Design ACM Symposium on Computational Fabrication **Boston, MA, US**

2019 Scientific Committee Association of Computer Aided Design in Architecture (ACADIA) **The University of Texas at Austin, US**

2019 Session Co-Chair International Association of Shell and Spatial Structures **Barcelona, Spain**

2019 - Peer Reviewer for Grant Proposals Swiss National Science Foundation (SNF) **Switzerland**

2019 Scientific Committee International Association of Shell and Spatial Structures **MIT, Boston, MA, US**

2018 - Peer Reviewer MDPI open Access Journals

2018 - Peer Reviewer Computer-Aided Design Journal **Elsevier**

2017 - 18 Chair Technology Committee **Weitzman School of Design**

2017 - Peer Reviewer International Journal of Space Structures **SAGE Journals**

2017 Competition Jury John Stewardson Competition **Weitzman School of Design**

Supervising Experience

Postdoctoral researchers: 3; 1 ongoing.
Doctoral students: 5 PhD (UPenn), 1 PhD (Female) Co-advising with ETH Zurich: ongoing.
Graduate students: 8 (3 Female).
Undergraduate students: 2 (1 Female).

Invited lectures

2021 SOM R&I Community Talk Chicago, US. Invited by Kyle Vancise

Title: *The Generative Power of Polyhedral Graphic Statics*

Log'rithms: Event 2 The Science of Architecture with City X Venice at the Italian Virtual Pavilion 2021. Invited by Cynitha Davidson

Title: *The Science of Architecture: Embedded Aesthetics*

Digital Consortium Lecture - Performance Based Digital Design Methodologies, Tongji University, China Invited by Prof. Philip Yuan

Title: *Geometry, Topology, Performance*

Babol Noshirvani University of Technology Babol, Iran Invited by Prof. Hamed Hamidi

Title: *Geometry, Topology, Performance*

2021 Digital FUTURES Talk: Light Structures, RMIT, Melbourne, Australia. Invited by Dr. Nic Bao and Prof. Dr. Mike Xie

Title: *Strength, Lightweightness, Efficiency*

2020 SNUDAAE, Seoul National University, South Korea. Invited by Prof. Joh Hong

Title: *Spatial Efficiency*

HDR, Portland , OR, US. Invited by Mr. Michael Roberts

Title: *Geometry-Based Structural Desing in 3D*

Cooper Union, NYC, NY, US. Invited by Mr. Thorsten Helbig

Title: *Spatial Efficiency*

2019 American Institute of Architects (AIA) , Philadelphia, PA, US. invited by Mrs. Rebecca Johnson

Title: *Spatial Efficiency Now*

Courant Institute of Mathematical Sciences, NYU, New York City, US. invited by Dr. Daniele Panozzo.

Title: *Funicular Polyhedral Structures*

schlaich bergermann partner (sbp), New York City, US. invited by Dr. Powell Draper.

Title: *Polyhedral Graphic Statics*

Facade Forum 2019, Thomas Jefferson University, Philadelphia, PA, US. invited by Dr. Jens Schneider.

Title: *On Geometry and Equilibrium of Force in 3D*

Knippers Helbig Advanced Engineering, New York City, US. invited by Mr. Thorsten Helbig.

Title: *Funicular Polyhedral Structures*

Princeton UniversityPrinceton, NJ, US. invited by Prof. Sigrid Adriaenssens.

Title: *Polyhedral Graphic Statics*

Skidmore, Owings & Merrill Co., Chicago, MI, US. invited by Mr. William F. Baker.

Title: *Polyhedral Graphic Statics*

Mechanical Engineering and Applied Mechanics Department, UPenn, Philadelphia, PA, US. invited by Prof. Mark Yim.

2018 Weitzman School of Design, University of Pennsylvania , Philadelphia, PA, US. MASTERLECTURE Series.

Mechanical Engineering and Applied Mechanics Department, UPenn, Philadelphia, PA, US. invited by Prof. Mark Yim.

Title: *On Geometry and Equilibrium of Force in 3D*

2017 HOK, San Francisco/New York City, US. in Research Talks.

Title: *Funicular Polyhedral Structures*

San Francisco Dynamo User Group, San Francisco, CA, US.Monthly Research Talks for Dynamo visual programming enthusiasts.

Title: *Design The Force*

Weitzman School of Design, University of Pennsylvania , Philadelphia, PA, US. MASTERLECTURE Series.

Title: *Spatial Funicular Structures*

2016 ETH Zurich, (NCCR) Digital Fabrication, Zurich, Switzerland. Lecture for Master of Advanced Studies.

Title: *3D Graphic Statics Using Polyhedral Reciprocal Diagrams*

Exhibitions

2021 Venice Biennale Architettura 2021 , part of Weitzman School of Design's virtual exhibition pavilion.

2019 American Institute of Architects (AIA) in Philadelphia at Center for Architecture and Design.

2019 Design Philadelphia at Pier 9.

2018 Design Philadelphia at Pennovation Center.