

Shadi Nazarian
Associate Research Professor
The Pennsylvania State University

Curriculum Vitae

February 6, 2023

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GENERAL INFORMATION

Contact information

Home: 348 Arbor Way, State College, PA 16803

Work: Penn State University, 222 Stuckeman Family Building, University Park, PA 16802

E-mail: sun14@psu.edu

Cell phone: +1 (716) 207 9927

Nationality

US Citizen

Languages

Persian (Native), English (Fluent), French (Basic)

EDUCATION

Post Professional Degree: Master of Architecture

May 1989

Cornell University, Department of Architecture, College of Architecture, Art and Planning, Ithaca, NY

Areas of Concentration:

Architectural Design and Theory of Architecture

Professional Bachelor of Architecture (5-year program)

June 1983

University of Minnesota, School of Architecture, College of Design, Minneapolis, MN

Bachelor of Environmental Design

June 1983

University of Minnesota, School of Architecture, College of Design, Minneapolis, MN

Area of expertise

Architecture; Environmental Design; Additive Manufacturing /Construction of concrete structures/3D concrete printing (3DCP); Fabrication aware design methods and processes; Design and fabrication of functionally graded materials and structures; Seamless and graded transitional interface between engineered geopolymer concrete and glass

Professional Development

Next Level Leadership: Changing the Future for Women Faculty at Penn State Leadership program.

CTF was a 6-month Empowerment and Leadership training program that promoted effective leadership competencies. It also provided exceptional insight into the responsibilities of a leader in academic and Entrepreneurial settings. (January 16, 2022, through June 21, 2022)

Ben Franklin TechCelerator Program Award, a nationally recognized program, in partnership with Invent-Penn-State increases technology transfer opportunities, by encouraging an entrepreneurial climate among PSU inventors. A few Colleagues from the ADDCON-lab completed the ten-week program to take our technology to the industry. Our products are focused on advancing construction technology by both creating demand for autonomous construction through education and providing a product to the market. We (Nate Watson, Shadi Nazarian, José Duarte, Ali Memari, and Sven Bilen) were awarded 2nd Prize at the final presentations and \$15,000 upon registering a start-up company. (April 7, 2020 - June 17, 2020).

<https://cnp.benfranklin.org/techcelerator-at-state-college>

ACADEMIC POSITIONS

(Teaching & Research)

- Jan. 2012 -present** **ASSOCIATE RESEARCH PROFESSOR**
Department of Architecture, School of Architecture and Landscape Architecture, College of Arts and Architecture, Penn State University
- Other Affiliations at Penn State:**
- Affiliate Faculty, Additive Manufacturing and Design Program** Apr. 2020– present
College of Engineering, Penn State University
- Affiliate Faculty, Material Research Institute (MRI)** Jan. 2015 – present
The Pennsylvania State University
- Affiliate Faculty, Stuckeman Center for Design Computing** Feb. 2016 – present
The Pennsylvania State University
- Founder and Director: Transitional Material Interface Laboratory** 2014- present
(TMI Lab), The Pennsylvania State University
- Co-Founder: Additive Construction Laboratory (AddCon Lab),** 2017-present
The Pennsylvania State University
- Affiliate Faculty: Material Matters Graduate Research Cluster,**
The Pennsylvania State University
- Member of Graduate School: M.Arch, M.S, M.S, M.Eng, AMD programs.**
The Pennsylvania State University
- 2002-2011** **CLINICAL ASSOCIATE PROFESSOR**
Department of Architecture, School of Architecture and Planning, State University of New York at Buffalo, Buffalo, N.Y.
Affiliate Faculty: Situated Technologies Graduate Research Group
Member of the Graduate Faculty
- 1999-2002** **VISITING ASSISTANT PROFESSOR**
Cornell University, Department of Architecture, College of Architecture, Art, and Planning (AAP), Ithaca, NY
Member of the Graduate Faculty
- 1994-1999** **CLINICAL ASSISTANT PROFESSOR**
Department of Architecture, School of Architecture and Planning, State University of New York at Buffalo, Buffalo, N.Y.
Member of the Graduate Faculty
- 1991-1992** **VISITING FACULTY**
Cornell University, Department of Architecture, College of Architecture, Art, and Planning (AAP), Ithaca, NY
- 1985-1989** **TEACHING ASSISTANT**
Cornell University, Department of Architecture, College of Architecture, Art, and Planning (AAP), Ithaca, NY

**PROFESSIONAL
DESIGN AND
CONSULTING**

CO-FOUNDER AND LEAD, ARCHITECTURAL DESIGN *April 2022-Present*

X-Hab 3D: Leading the design, optimization, and manufacturing of 3D-printable structures, exploring the affordances of 3D Concrete Printing, developing innovative extrudable materials that are environmentally friendly, low carbon, and locally sourced,

PARTNER *1994-present*

Studio for Architecture: Architectural Design and Research

ARCHITECTURAL DESIGNER

Thomas Associates, Ithaca, N.Y. *1992-1994*

Design and development of small and medium scale projects with a focus on educational facilities

Pei Cobb Freed & Partners, New York, N.Y. *1989-1991*

Architectural design and development, representational drawings and details, and presentations. Two major projects with James Ingo Freed: "The San Francisco Main Public Library", and "The Federal Triangle" in Washington DC.

ARCHITECTURAL INTERN

1100 Architects, New York, N.Y. *1988-1989*

Worked on design and development of residential projects and presentation drawings for "NY Architects" exhibition in Frankfurt Museum.

Demjanec & Wilson Architects, Ithaca, N.Y. *1987-1989*

Worked on design and development of several residential projects.

HONORS & AWARDS

- Oct 20, 2022 **Golden Medal**, for Novel mixture design method for 3D printing eco-friendly concrete using granulated cork, Innowings 2022. (Collaborative)
- 2022 **Humanitarian Materials Award**, Material Research Institute
- 2021 **Benn Franklin in support of start-up X-Hab 3D-** \$15,000
- May 4, 2019 **NASA 3D-printed Mars Habitat Challenge Award**, Phase 3 - On-Site Habitat Competition, Construction Level 3 – Subscale construction- Penn State team earned 2nd Prize and was awarded \$200,000. (Role: Team Leader)
- 2019 **NASA 3D-printed Mars Habitat Challenge Award**, Phase 3 -, Construction Level 2 – Hydrostatic Test Competition, Penn State team earned 3rd Prize and was awarded \$83,755.92. (Role: Team Leader)
- 2018 **NASA 3D-printed Mars Habitat Challenge Award**, Phase 3- Construction Level 1 – Foundation Test Competition, Penn State team earned 2nd Prize, and was awarded \$32,914.75. (Role: Team Leader)
- 2017 **NASA 3D-printed Mars Habitat Challenge Award**, Phase 2 - Structural Member Competition, Level 3 – Head-to-Head Competition, Penn State team was awarded 2nd Prize, and was awarded \$150,000. (Role: Team Leader)
- 2016 **Recognition of the newly disclosed technology as one of 40 most disruptive** Penn State Technologies, “Invent Penn State Innovation Guide. (Role: Project Lead, Collaborative)
- 2007 **New York State Council on the Arts (NYSCA)**, \$15,000 Individual Artist Award, in the category of Media and New Technology, for project *Introversions*. (Peer reviewed)
- 2007 **New York Foundation for the Arts Special Opportunity Award**: \$600 for Project *Introversions: The Lure*. (Peer reviewed)
- 2000 **New York Foundation for the Arts (NYFA)**, \$7000 Artists' Fellowship Award in the category of Architecture. (Peer reviewed)
- 1999 **Arts Council, Buffalo and Erie County, DEC-CIP Individual Artist Award**, \$1200.00 in support of “Thresholds: The Arcades Project”. (Peer reviewed)
- 1999 **The Main Street/Art Street: The Windows Project** Award of \$2150 for transforming dormant Buffalo storefronts into a 24-hour Gallery.
- 1998 **Austrian Cultural Institute Competition in Manhattan**, 5th Place Prize (collaborative). Selected among 500 international entries-\$5000 awarded. (Peer reviewed)
- 1992 **Center for Exploratory and Perceptual Arts Board of Directors Awards**: Honorable Mention for Space of Locomotion. \$1000 awarded
- 1999 **Joint Winner in the “Landscapes for the 21st Century” competition**, by the American Society of Landscape Architects. Collaborative project
- 1990 **Special Prize of Merit for Conceptual Design, in Peace Garden International Design Competition**, Juried Selection out of 2000 entries, (Collaborative)
- 1989 **Joint Winner in the Diomedea International Design Competition**, Juried Selection out of 1897 entries, Collaborative Project.
- 1989 **The Richmond Harold Shreve Award**, in recognition of work of outstanding originality and excellence. Cornell University.

FUNDED RESEARCH ACTIVITY (Selected Grants/ Contracts)

Projects as PI or Researcher

Design and Validation of Integrated Hatches into 3D-printed Habitat. *Funding:* 2023 Cooperative Agreement Notice (CAN) for Dual-Use Technology Development at Marshall Space Flight Center, NASA Solicitation number: 80MSFC22M0001. **Role:** *Project Lead and Principal Investigator (PI) Team: José Duarte (Co-PI), Sven Bilén (Co-PI), Ali Memari (Co-PI), Aleksandra Radlińska (Co-PI).* *Total Requesting: \$200,000 (White Paper in Progress, Due: April 19, 2023)*

Research, Development, and Demonstration of Technical Feasibility and Cost Effectiveness of 3D Concrete Printing as an Alternative to Conventional (“Stick-Built”) Construction for Affordable Housing in Alaska’s Sub-Arctic Region. *Funding: Proposal for HUD Grant Relating to Research Partnerships FR-6500-N-USP. Role: Co-Principal Investigator (Co-PI) Team: José Duarte (PI), Aleksandra Radlińska (Co-PI), Nathan Brown (CO-PI), Rahman Azari (CO-PI), Ali Memari (CO-PI), Ming Xiao (Co-PI) from Penn State; several other researchers are from: X-Hab 3D, Extreme Habitat Institute (XHI) Cold Climate Housing Research Center and National Renewable Energy Laboratory (CCHRC, NREL), University of Alaska Fairbanks, Alaska Housing Finance Corporation, and several other entities. Total Funding: \$2.5 million. (Proposal in Progress)*

Artificial Intelligence for Digital Design and Synthesis for 3D-Printing of Functionally Graded Materials Using Large-Scale AI-Guided Computational Techniques. *Funding for: Interdisciplinary Seed Grant Opportunities in Multiple Areas across Partnerships in OSVPR, Theme: AI for Accelerating Materials Discovery, Design, and Synthesis. Role: Principal Investigator (PI) Team: José Duarte (Co-PI), Guido Cervone (Co-PI), John Mauro (Co-PI), Aleksandra Radlińska (Co-PI), Rahman Azari ((Co-PI), Nathan Brown (Co-PI). Total Requested: \$50,000. Submitted on January 24, 2023.*

Design and construction of 3D printed buildings as carbon sinks: accelerated carbonation using functionally graded fiber reinforced concrete extrusion *Funding: DE-FOA-0002625 Technical Areas: Primary Technical Area: Category B - Building Designs Secondary Technical Area: Category A- Building Materials, Role: Co-Principal Investigator (Co-PI) Team: several researchers from NREL and Penn State AddCon Lab. (Fed: \$3,000,000, Cost Share: \$225,000, Total: \$3,225,000) Project Duration: 36 months. Submitted on December 2020, 2021, Not Funded.*

Advanced manufacturing for integrated thermal and structural building envelopes through additive concrete deposition, 3D pultrusion, and robotic assembly *Funding: DE-FOA-0002459 Technical Area: Category 3- Building Efficiency, Sub-category E - Building Envelope. Role: Co-Principal Investigator (Co-PI) Team: several researchers from NREL and Penn State AddCon Lab. (\$7,605,221) Project Duration: 36 months. Submitted on August 31, 2021, Not Funded.*

Analyses of concrete samples with ingredients and engineering Feb 2021 – May 21 analysis of concrete 3D printed box shaped housing structure (extended) *Funding: Xtreme Habitat Institute, USA. Role: Co-Principal Investigator (Co-PI) Team: A. Memari (PI), Aleksandra Radlinska, José Duarte, Nathan Brown, Sven Bilén, Xiao Ming. (\$56,314)*

Development of lightweight concrete for 3D printing Jan 2022 – Dec 22
Funding: Materials that Matter at the Human Level - MRI Grant, Penn State, USA.
Role: Co-Principal Investigator (Co-PI) Team: Aleksandra Radlinska (PI), José Duarte, A. Memari, Sven Bilén. (\$10,000)

National Endowment for the Arts, Penn State Internal down select Review for limited submission. **Role: Principal Investigator (PI)**. To fabricate sculptors depicting unique affordances of Advanced Functionally Graded Ceramics, manifested by seamless and graded transition between transparent glass and geopolymer mortar, scalable from nanoscale to macro-scale of architecture. (May 28, 2020).- Applications was not forwarded

MRI: Acquisition of a 14 Tesla Magnetic Resonance Micro-Imaging System for Rheological, Biological, Preclinical and Materials Research
Funding: NSF ERC, USA. Role: Co-Principal Investigator (Co-PI) Team: Thomas Neuberger (PI). (Preliminary proposal submitted: January 2019-Not Funded)

Development of Cement-Free Concrete for 3D Printing of Homes Jan 2019 – Dec 19
Funding: Materials that Matter at the Human Level - MRI Grant, Penn State, USA.
Role: Co-Principal Investigator (Co-PI) Team: A. Memari (PI), José Duarte, Sven Bilén, Aleksandra Radlinska, Nick Meisel, Maryam Hojati. (\$10,000)

Development of Sustainable Concrete for 3D-printing Jan 2019 – Dec 19
Funding: ENGINEERING for Innovation & ENTREPRENEURSHIP (ENGINE) Grants, Penn State, USA.
Role: Co-Principal Investigator (Co-PI) Team: A. Memari (PI), José Duarte, Sven Bilén, Aleksandra Radlinska, Nick Meisel, Maryam Hojati. (\$75,000)

Additive Manufacturing of Concrete May 2017 – 2022
Funding: Autodesk, USA. Role: Co-Principal Investigator (Co-PI) Team: J. Duarte (PI), S. Bilén, A. Radlinska, A. Memari, Nick Meisel, F. Craveiro, N. Ashrafi, M. Hojati, Minhyeok ko. (\$150,000)

Materials by Design: from functionally-graded materials to seamless architecture Jul. 2016 – June 2018
Funding: The Bowers Grant Program for Excellence in Design and Construction, Penn State, USA. Role: Co-Principal Investigator (Co-PI) Team: J. Duarte (PI), T. Baird, T. Simpson, C. Tucker, A. Radlinska, F. Craveiro, N. Ashrafi. (\$70,000)

Computing with Materials: towards seamless architecture Jul. 2016 – Dec. 2017
Funding: The Materials Research Institute (MRI) and the Penn State Institute of Energy and the Environment (PSIEE), Penn State, USA. Role: Principal Investigator (PI) Team: José Duarte (Co-PI), M. Hojati. (\$32,000)

PUBLICATIONS

Articles in International Peer- Reviewed Journals

Ashrafi, N.; **Nazarian, S.**; Meisel, N.A.; and Duarte, J.P. A grammar-based algorithm for toolpath generation: Compensating for material deformation in the additive manufacturing of concrete. in *Journal of Additive Manufacturing* 55, no. 102803. (2022): pp. 1-20. DOI: <https://doi.org/10.1016/j.addma.2022.102803>

<https://doi.org/10.1016/j.addma.2022.102803>

An algorithm to decompose structures into printable geometries by decomposing them into basic building elements, to compensate for material deformation in small scale concrete 3d-printing, a non-comprehensive composition shape grammar to create concrete 3D-printable geometries, and a non-comprehensive decomposition grammar to decompose geometries to 3D print in concrete.

Hojati, M.; Li, Z., Memari, A.; Park, K., Zahabi, M.; **Nazarian, S.**; Duarte, J.; Radlińska, R. Mixture Design and Mechanical Properties of Sustainable Cementitious Materials for 3DPrinting, in *Results in Engineering Journal, Elsevier.* (Submitted on October 31, 2021, accepted on January 13, 2022) Submitted

Ashrafi, N.; **Nazarian, S.**; Meisel, N.; Duarte, J. Experimental calibration, and compensation for the continuous effect of time, number of layers and volume of material on shape deformation in small-scale additive manufacturing of concrete, in *Journal of Additive Manufacturing, Volume 47, November 2021, 102228.* (Submitted May 5, 2020, Revised July 6, 2021, Accepted August 2, 2021, Published online August 6, 2021) <https://doi.org/10.1016/j.addma.2021.102228>

Meisel, N.; Watson, N.; Bilén, S.; Duarte, J.P.; **Nazarian, S.** Design and System Considerations for Construction-Scale Concrete Additive Manufacturing via Robotic Arm Deposition, in *3D Printing and Additive Manufacturing.* (Submitted December 16, 2020, revised April 8, 2021, accepted April 26, available online August 2, 2021) <http://doi.org/10.1089/3dp.2020.0335>

Li, Z.; Hojati, M.; Duarte, J.; **Nazarian, S.**; Bilén, S.; Memari, A.; Radlinska, A. Towards 3Dprintable cementitious materials on Earth and beyond, in *Concrete Engineering International, January 2021, pp. 18-20.*

Ashrafi, N.; **Nazarian, S.**; Meisel, N.; Duarte, J. Experimental Prediction of Material Deformation in Large-Scale Additive Manufacturing of Concrete, in *Journal of Additive Manufacturing, Volume 37, 2021.* DOI: <https://doi.org/10.1016/j.addma.2020.101656> (Submitted on June 10, revised on September 14, accepted on October 6, 2020, Available online 13 October 2020, publication on January 2021)

Li, Z.; Hojati, M.; Wu, Z.; Piasente, J.; Ashrafi, N.; Duarte, J.P.; **Nazarian, S.**; Bilén, S.G.; Memari, A.M.; Radlińska, A. Fresh and Hardened Properties of Extrusion-Based 3Dprinted Cementitious Materials: A Review. *Sustainability* 2020, 12(14), 5628. DOI: <https://doi.org/10.3390/su12145628> (Received: 17 June 2020, revised: 8 July 2020, Accepted: 10 July 2020, Published: 13 July 2020)

Craveiro, F.; Bártolo, H.; Bártolo, P.; **Nazarian, S.**; Duarte, J.P. An automated system for 3D printing functionally graded concrete-based materials, in *Additive Manufacturing, Volume 33, May 2020.* <https://doi.org/10.1016/j.addma.2020.101146> (Available online 22 February 2020)

Ashrafi, N.; Duarte, J.P.; **Nazarian, S.**; Meisel, N. Evaluating the Relationship between Deposition and Layer Quality in Large-Scale Additive Manufacturing of Concrete, in Bourel, David (ed.) *Journal of Virtual and Physical Prototyping*, March 2018, pp. 2-6. Doi: <https://doi.org/10.1080/17452759.2018.1532800>

Abstracts in International Peer- Reviewed Journals

Nazarian, Shadi. Innovations in Materials: Materials by Design. Submitted to ARCC

Nazarian, Shadi, and Aleksandra Radlinska. *The 5th International Conference on Architecture & Built Environment*. Fly Ash Based Geopolymer Ceramics to Soda Lime Glass: A building Material for Seamless Architecture, Venice. Peer-reviewed/refereed.

Nazarian, Shadi, and Aleksandra Radlinska. *The 5th International Conference on Architecture & Built Environment*. "Fly Ash Based Geopolymer Ceramics to Soda Lime Glass: A building Material for Seamless Architecture," Venice. Peer-reviewed/refereed.

Nazarian, Shadi, and Jose Pinto Duarte. From Functionally Graded Materials to Seamless Architecture. *The 5th International Conference on Architecture & Built Environment*. Peer-reviewed/refereed.

Hojati, Maryam, Ali M. Memari, Mehrzad Zahabi, Zhengyu Wu, Zhanzhao Li, Keunhyoung Park, **Shadi Nazarian**, and Jose Pinto Duarte. Barbed-Wire Reinforcement for 3D Concrete Printing. *Automation in Construction* Volume 141. (2022). <https://doi.org/10.1016/j.autcon.2022.104438>

Difficulty of incorporating steel-reinforcement into 3D-printed concrete and formation of cold-joints between successively 3D-printed filaments prevents its acceptance in the construction industry. Use of barbed wires as a post-installed reinforcement technique to improve the tensile resistance of 3D-printed concrete elements and bonding between 3D-printed concrete and embedded reinforcing elements.

Articles in International Professional Magazines

Hojati, Maryam, ZhanZhao Li, Ali Memari, K. Park, Mehrzad Zahabi, **Shadi Nazarian**, Jose Pinto Duarte, and Aleksandra Radlinska. "3D-printable quaternary cementitious materials towards sustainable development: Mixture design and mechanical properties." *Results in Engineering* 13, no. 100341. (2022). DOI: <https://doi.org/10.1016/j.rineng.2022.100341>, ISBN/ISSN: ISSN 2590-1230 <https://doi.org/10.1016/j.rineng.2022.100341>

Highlights: Material properties of 12 mixtures, including binary, ternary, and quaternary cementitious blends, were investigated. According to the printing system and tests, a printable mixture with 32.5% cement replacement was selected for this study. Mechanical properties of 3D-printed prisms in perpendicular and longitudinal directions were compared with cast prisms.

Ashrafi, Negar, **Shadi Nazarian**, Nicholas A. Meisel, and Jose Pinto Duarte. Experimental Prediction of Material Deformation in Large-Scale Additive Manufacturing of Concrete. *Journal of Additive Manufacturing* 37, no. 101656. (2021). DOI: <https://doi.org/10.1016/j.addma.2020.101656>

Li, Zhanzho, Maryam Hojati, José Duarte, **Shadi Nazarian**, Sven Bilén, Ali Memari, and Aleksandra Radlinska. Towards 3D-Printable Cementitious Materials on Earth and Beyond: An Introduction to Development Efforts for Cementitious Materials That Are Compatible With 3D Printing, Including Cement-Based and Geopolymer- Based

Binders, As Well As Functionally Graded Materials. *Concrete Engineering International (CEI)*, January 2021. 18-20. Peer-reviewed/refereed.

Meisel, Nicholas A., Nathan Watson (Co-Author - Graduate Student), Sven Bilén, José Duarte, and **Shadi Nazarian**. Design and System Considerations for Construction-Scale Concrete Additive Manufacturing in Remote Environments Via Robotic Arm Deposition. *The Journal of 3D Printing and Additive Manufacturing*. (2021). DOI: <http://doi.org/10.1089/3dp.2020.0335>
<https://www.liebertpub.com/doi/full/10.1089/3dp.2020.0335>

Li, Zhanzho, Maryam Hojati, Z. Wu, J. Piasente, N. Ashrafi, José Duarte, **Shadi Nazarian**, Sven Bilén, Ali Memari, and Aleksandra Radlinska, et al. Fresh and Hardened Properties of Extrusion-Based 3D-Printed Cementitious Materials: A Review. *Sustainability* 5628th ed 12, no. 14. (2020). DOI: <https://doi.org/10.3390/su12145628>, ISBN/ISSN: ISSN 2071-1050 <https://www.mdpi.com/2071-1050/12/14/5628/htm>

Craveiro, Flávio, Helena Bártolo, Paulo J. Bártolo, **Shadi Nazarian**, and Jose Pinto Duarte. An automated system for 3D printing functionally graded concrete-based materials. *Journal of Additive Manufacturing* 33, no. 101146. (2020): 10. DOI: <https://doi.org/10.1016/j.addma.2020.101146>

Highlights: A system for the additive manufacturing of functionally graded concrete parts was developed, using Cork as a viable natural aggregate; 3D-printed functionally graded concrete parts by varying the type and ratio of aggregates, and homogeneous and functionally graded parts were produced with the system.

Watson, Nathan, Nicholas A. Meisel, Sven G. Bilén, Jose Pinto Duarte, and **Shadi Nazarian**. Large-Scale Additive Manufacturing of Concrete using a 6-Axis Robotic Arm for Autonomous Habitat Construction. *Proceedings of the 30th International Solid Freeform Fabrication Symposium, Austin, TX, August 12-14, 2019*. (2019).

Ashrafi, Negar, José Duarte, **Shadi Nazarian**, and Nicholas Meisel. Evaluating the Relationship between Deposition and Layer Quality in Large-Scale Additive Manufacturing of Concrete. *Journal of Virtual and Physical Prototyping* 14, no. 2. (2018): 135-140. DOI: <https://doi.org/10.1080/17452759.2018.1532800>

Craveiro, Flavio, José Duarte, and **Shadi Nazarian**. Characterization of cork concrete materials for functionally graded additive manufacturing. *Construction & Building Materials*. (2019).

Brown N.; Duarte, J.; Memari, A.; Xiao, M.; **Nazarian, S.**; Duarte, G.; Wu, Z. A comparison of thermal insulation strategies for 3D printed concrete structures in cold regions, in Proceedings of the 6th RBDCC – Residential Building Design and Construction Conference, State College, PA, 4th – 6th March 2022, pp. ??-??. (Submitted September 2021)

Muthumanickam, N.; Duarte, J.; **Nazarian, S.**; Bilén, S.; Memari, A.; BIM for design generation, analysis, optimization and construction simulation of a Martian habitat, in Proceedings of the ASCE Earth & Space Conference, Seattle, WA, 20th – 22nd April 2021, pp. ??-??.

Muthumanickam, N.; Park, K.; Duarte, J.; **Nazarian, S.**; Memari, A.; Bilén, S. BIM for parametric problem formulation, optioneering and 4D simulation of 3D printed Martian habitat: A Case Study of the NASA 3D Printed Habitat Challenge, in Proceedings of the

5th RBDCC – Residential Building Design and Construction Conference, State College, PA, 4th – 6th March 2020, pp. 578-593.

Park, K.; Memari, A.; Hojati, M.; Zahabi, M.; **Nazarian, S.**; Duarte, J. Experimental Testing and Finite Element Modeling of 3D-Printed Reinforced Concrete Beams, in Proceedings of the 5th RBDCC – Residential Building Design and Construction Conference, State College, PA, 4th – 6th March 2020, pp. 536-550.

Park, K.; Memari, A.; Hojati, M.; Zahabi, M.; **Nazarian, S.**; Duarte, J. Structural Analysis of Full-Scale and Sub-Scale Structure for Digitally Designed Martian Habitat, in Proceedings of the 5th RBDCC – Residential Building Design and Construction Conference, State College, PA, 4th – 6th March 2020, pp. 518-535.

Nazarian, S.; Duarte, J.P.; Bilén, S.G.; Memari, A.; Muthumanickam, N.K.; Watson, N.; Radlinska, A.; Ashrafi, N. and Hojati, M. An Overview of the Execution of 3D-Printed Subscale Habitat on Mars: A Case Study to Exemplify the Automated Construction Process, in Proceedings of the 5th RBDCC – Residential Building Design and Construction Conference, State College, PA, 4th – 6th March 2020, pp. 512-517.

Nazarian, S.; Duarte, J.P.; Bilén, S.; Memari, A.; Radlinska, A.; Meisel, N.; Hojati, M. Additive Manufacturing of Architectural Structures: An Interplay between Materials, Systems, and Design, in Proceedings of the CIAC 2019 – Conference on Automation Innovation in Construction, on Sustainability and Automation in Smart Construction, Leiria, Portugal, November 7-8, 2019, pp. 111-120.

Watson, N.; Meisel, N.; Bilén, S.; Duarte, J.P.; **Nazarian, S.** Large-Scale Additive Manufacturing of Concrete using a 6-Axis Robotic Arm for Autonomous Habitat Construction, in Proceedings of the 30th International Solid Freeform Fabrication Symposium, Austin, TX, August 12-14, 2019.

Fei, Guo; Castro e Costa, E.; Duarte, J.P.; **Nazarian, S.** Computational Implementation of a Tool for Generative Design of High-rise Residential Building Facades, in Ji-Hyun Lee (ed.) Proceedings of the CAAD Futures Conference, Daejeon, South Korea, June 26-28, 2019, pp. 301-316. ISBN 978-89-89453-05-5

Duarte, J.; **Nazarian, S.** and Ashrafi, N. Designing shelters for 3D-printing: A studio experiment, in Kępczyńska-Walczak, A. (ed.) - Proceedings of the 36th eCAADe Conference, *Virtual & Physical Prototyping* 2, no. Lodz, Poland, September 19-21, 2018, pp. 31-38.

Ashrafi, N.; Duarte, J.P.; **Nazarian, S.**; Meisel, N. Evaluating the Relationship between Deposition and Layer Quality in Large-Scale Additive Manufacturing of Concrete, in Bourel, David (ed.) Proceedings of the 2018 Solid Freeform Fabrication Symposium Proceedings, SFF Symp 2018, Austin, TX, August 13-15, 2018.

Ko, M.; Memari, A.; Duarte, J.; **Nazarian, S.**; Ashrafi, N.; Craveiro, F.; and Bilén, S. Preliminary Structural Testing of a 3D Printed Small Concrete Beam and Finite Element

Modeling of a Dome Structure, in Proceedings of the 42nd IAHS World Congress on the housing for the dignity of mankind, Naples, Italy, 10-13th April 2018, pp. 125.

Hojati, M.; **Nazarian, S.**; Duarte, J.; Ashrafi, N.; Radlińska, A.; Craveiro, F.; and Bilén; 3D Printing of Concrete: A Continuous Exploration of Mix Design and Printing Process, in Proceedings of the 42nd IAHS World Congress on the housing for the dignity of mankind, Naples, Italy, 10-13th April 2018, pp. 124.

Hojati, M.; **Nazarian, S.**; Duarte, J.; Seamless Architecture: Design and Development of Functionally Graded Green Materials for Building Construction, in Proceedings of the 4th RBDCC – Residential Building Design and Construction Conference, State College, PA, 27th February-1st March, 2018, pp. 515-528. Published as book chapter

**Articles in
International Peer-
Reviewed
Conferences**

Muthumanickam, Naveen K., **Shadi Nazarian**, José Duarte, and Sven Bilén. Metamodels for rapid analysis of large sets of building designs for robotic constructability: Technology demonstration using the NASA 3D Printed Mars Habitat Challenge. *Proceedings of the ASCE Earth & Space Conference*, April 2022. 15. Peer-reviewed/refereed.

Brown, Nathan, Jose Pinto Duarte, Ali Memari, Ming Xiao, **Shadi Nazarian**, Gonçalo Duarte, and Z Wu. A comparison of thermal insulation strategies for 3D printed concrete structures in cold regions. *Proceedings of the 6th RBDCC – Residential Building Design and Construction Conference*, March 6, 2022. Peer-reviewed/refereed.

Hojati, Maryam, Ali Memari, **Shadi Nazarian**, and Jose Duarte. Lessons learned from post-collapse of fresh and hardened 3D-printed concrete components. *Proceedings of Digital Concrete 2020 – 2nd RILEM International Conference on Concrete and Digital Fabrication*, July 2020. Peer-reviewed/refereed.

Muthumanickam, Naveen, K. Park, Jose Duarte, **Shadi Nazarian**, Ali Memari, and Sven Bilen. BIM for parametric problem formulation, optioneering and 4D simulation of 3D printed Martian habitat: A Case Study of the NASA 3D Printed Habitat Challenge. *Proceedings of the 5th RBDCC – Residential Building Design and Construction Conference*, March 2020. pp. 578-593. Peer-reviewed/refereed.

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Park, Keunhyoung, Ali Memari, Maryam Hojati, Mehrzad Zahabi, **Shadi Nazarian**, and José Duarte. Structural Analysis of Full-Scale and Sub-Scale Structure for Digitally Designed Martian Habitat. *Proceedings of the 5th RBDCC – Residential Building Design and Construction Conference*, March 2020. 518-535. Peer-reviewed/refereed.

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CAAD Futures 2019 Conference paper submission

Hojati, Maryam, Aleksandra Radlinska, **Shadi Nazarian**, Jose Pinto Duarte, Ali M.

Memari, Nicholas A. Meisel, and Sven G. Bilen *the 1st International Conference on Concrete and Digital Fabrication: Digital Concrete. Synthesis and 3D Printing of One-Part Geopolymer Mortar*, Zurich, 2018. Peer-reviewed/refereed.

Hojati, M., **Shadi Nazarian**, and J. Duarte. in *Proceedings of the 4th RBDCC – Residential Building Design and Construction Conference, State College, PA, 27th February-1st March, 2018, Seamless Architecture: Design and Development of Functionally-Graded Green Materials for Building Construction*, 2018. 515-528. Peer-reviewed/refereed.

Muthumanickam, Naveen, Jose Duarte, **Shadi Nazarian**, Sven Bilén, and A. Memari. *BIM for design generation, analysis, optimization, and construction simulation of a Martian habitat. Proceedings of the ASCE Earth & Space Conference*, April 2021. Peer-reviewed/refereed. ASCE Earth & Space Conference was delayed due to the pandemic and took place on 20th – 22nd April 2021.

Roman, Monserrate, Michael Fiske, **Shadi Nazarian**, Melodie Yashar, Jacob Ballard, Michael Bentley, Platt Boyd, and Amanda M. Adams *3D-Printing Lunar and Martian Habitats and the Potential Applications for Additive Construction. 50th International Conference on Environmental Systems*, 2020. 10. Peer-reviewed/refereed. <https://hdl.handle.net/2346/86486>

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Park, K., Memari, A. M., Duarte, J. P., and **Nazarian, S.**, (2019). *Development of Optimal Toolpath and Shape Design Process for 3D Printing of Concrete*, Poster presented at the Architectural Engineering Institute (AEI) 2019 Conference – Integrated Building Solutions – The National Agenda, Tysons Center, VA, April 3-6, 2019. Hojati, M.; Radlinska, A.; **Nazarian, S.**; Duarte, J., Memari, A.; Meisel, N.; and Bilén, S. *Synthesis and 3D Printing of One-Part Geopolymer Mortar*, 1st RILEM International Conference on Concrete and Digital Fabrication, Zurich, September 9, 2018.

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Duarte, J.P.; **Nazarian, S.**; Davis, F.; Gursoy, B.; Miller, M.; Costa, E. *Design Computing Research*, The ICS 2018 Symposium: Harnessing the Power of Data, Institute for CyberScience, Penn State, USA, March 30, 2018

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Craveiro, F.; Bártolo, H.; Bártolo, P.; **Nazarian, S.;** Duarte, J.P.; Designing and production of Cork-based Functionally Graded Concrete Walls, Materials Day 2017, Materials Research Institute, Penn State, USA, October 17-18, 2017.

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Book Chapters & Manuscripts

Nazarian, Shadi; J. Duarte, and M Hojati. Seamless building Envelopes: Design and Development of Functionally Graded Composite Materials.

This 75-page manuscript wis being prepared to be incorporated into the Springer Brief Book proposal. (In Progress)

Nazarian, Shadi. Portfolio - Mapping of your Avatar.

A book proposal to the editor of "The Arts in Higher Education" book series with Springer-Palgrave described to address "The role the arts play in higher education continues to be a complex and highly debated topic, especially in the changing climate

of North American education". (In Progress)

Muthumanickam, Naveen, Jose Pinto Duarte, **Shadi Nazarian**, Ali Memari, and Sven Bilén. Combining AI and BIM in the Design and Construction of a Mars Habitat. In *Space Exploration, Utilization, Engineering, and Construction in Extreme Environments*, edited by Imdat As & Basu, Prithwish. Abingdon: Routledge Companion for AI in Architecture, 2021. pp. 1208- 1219. Peer-reviewed/refereed. ISBN/ISSN: 97803674245892021 <https://www.routledge.com/The-Routledge-Companion-to-Artificial-Intelligence-in-Architecture/As-Basu/p/book/9780367424589>
Describing our work during the NASA Challenge, we articulated our practical approach, critical views on tools and techniques, and suggested future directions for meaningful uses of AI technology in Architecture.

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Highlights numerous examples of smart construction technologies, demonstrates the use and application of new construction materials and technologies, and discusses recent trends in automation as applied to the construction sector.

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Nazarian, Shadi, and Mehrdad Hadighi. *New York: Nomadic Design*, edited by Ronald Christ, Dennis Dullens. "'The Peace Armor" and "toASt(e)IR", Barcelona: Gustavo Gili S.A., 1993. 90-91.

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Posters and Videos

Academic/Scholarly

Nazarian, Shadi, Pinto Duarte, Jose, Bilén, Sven, G., Memari, Ali. From Lab to Site: Innovations in Concrete, Penn State ADDCON Team, Taubman College of Architecture and Urban Planning, Liberty Research Annex and Gallery, 305 W. Liberty Rd., Ann Arbor, MI, 48103, peer-reviewed/refereed, by Invitation, Academic. (October 31, 2019 - January 17, 2020). <https://taubmancollege.umich.edu/labs-workshops/liberty-research-annex>

Park, Keunhyoung, Ali Memari, José Duarte, and **Shadi Nazarian**. *Presented at the Architectural Engineering Institute (AEI) 2019 Conference, Integrated Building Solutions – The National Agenda, Tysons Center, VA, April 3-6, 2019*. "Development of Optimal Tool-path and Shape Design Process for 3D Printing of Concrete," 2019. Peer-reviewed/refereed.

Duarte, José, **Shadi Nazarian**, Felecia Davis, Benay Gursoy, Marc Miller, and E. Costa. *The ICS 2018 Symposium: Harnessing the Power of Data, Institute for CyberScience, Penn State, USA, March 30, 2018*. "Design Computing Research," 2018. Peer-reviewed/refereed.

Nazarian, Shadi, José Duarte, Sven Bilén, Ali Memari, Aleksandra Radlinska, Nicholas Meisel, Flavio Craveiro, and Maryam Hojati. *Materials Day 2017, Materials Research Institute, Penn State, USA, October 17-18, 2017*. "MARSCRETE: Design of 3D-Printable Concrete for Martial Habitat," 2017. Peer-reviewed/refereed.

Craveiro, Flavio, H. Bártolo, P. Bártolo, **Shadi Nazarian**, and José Duarte. *Materials Day 2017, Materials Research Institute, Penn State, USA, October 17-18, 2017*. "Designing and production of Cork-based Functionally-Graded Concrete Walls," 2017. Peer-reviewed/refereed.

Research Reports

Memari, A., **Nazarian, S.**, Pinto Duarte, J., Bilén, S., Radlinska, A., & Hojati, M. Final Report, December 2020. Development of Sustainable Concrete for 3D-Printing. (pp. more than 100). \$75,000 was awarded to our team to develop two different concrete mixture designs suitable for 3D-printing, one that uses Portland cement, and one using a non-cementitious environmentally friendly binder. (Collaborative- Interdisciplinary)

Nazarian, S., Memari, A. M., Pinto Duarte, J., Hojati, M., & Radlinska, A. Final Report, December 30, 2019. Development of Cement-Free Concrete for 3D Printing of Homes. (pp. 3).

Nazarian, S., Memari, A. M., Pinto Duarte, J., Bilén, S. G., Hojati, M., Meisel, N. A., & Radlinska, A. Annual Report, July 23, 2019. Development of Sustainable Concrete for 3D-printing. (pp. 7). https://www.youtube.com/watch?v=-HT_MhzYkus
<https://www.youtube.com/watch?v=jBIZPLwz1Fs>
https://www.youtube.com/watch?v=tzA_yKFYJw
<https://www.youtube.com/watch?v=iVDY5m2lx3w>

<https://www.youtube.com/watch?v=vDXzoVvtcU>

Documents related to the ENGINE project include Report on design of concrete mixtures; Report on testing beams and blocks to prove the concept of BW reinforcement; Invention Disclosures: one on concrete mixture design, and one on the concept of using barbed wire as a reinforcement for 3D printed concrete.

Objectives and Status Material Mixture: Designing two different concrete mixtures for target applications, i.e., construction on Earth.

Status: Cement-based done, cement free a revision of *Marscrete(TM)*

Reinforcement Design: Develop a new concept for reinforcement of 3DPC;

Status: Concept proved successfully through extensive tests

Material Characterization and Design: Modeling the fresh properties of material needed for toolpath design;

Status: Nearly complete as part of the testing and component printing

Printing Process/System: Advancing the printing process and system

Status: Complete, mainly as part of preparation for the NASA ¼ scale habitat head-to-head competition

Nazarian, S. Annual Report, 2017. Additive Manufacturing of Glass: Exploring Innovative Material Interfaces and Dawn Of A New Era In Architecture.

Nazarian, S. Quarterly Report, 2017. Deformation of Fresh-state Concrete After Extrusion. (pp. 2). Have provided Autodesk with reports of our progress on a regular basis. Stage 1: Collection of data: Conducting Iterative printing tests and keeping precise measurement and records and all variables including materials, printing systems, and Design decisions: including huge range of variables such as environmental conditions, systems changes, robotic arm direction, speed, and deformation of fresh-state concrete

Nazarian, S. Annual Report, 2017. Wall Panel: A comparative cost study. (pp. 2). The suggested methodology calculates and compares the cost of conventional wall panel with built-in seamless windows, versus a cast one using my patented seamless and functionally graded technology.

Nazarian, S. Annual Report, 2016. From Functionally Gradient Materials to Seamless Architecture. (pp. 5).

Nazarian, S. Final Report, 2015. NCMA Competition: Student's Leaning Experiences. (pp. 3).

Nazarian, S. Final Report, January 11, 2015. The H. Campbell and Eleanor R. Stuckeman Fund for Collaborative Design Research. (pp. 69).

Architects are trained to turn constraints into creative opportunities. This can make them great contributing partners in scientific explorations. However, they have been among the least engaged professionals in the development of newly engineered materials, or modification of existing ones. With an interest in Glass Science and Technology, I have established a cross-disciplinary dialogue with professor Pantano, a mentor, providing guidance and resources. Together we have begun a workshop engaging students in a series of explorations using recycled glass, molten glass, ceramics, sand, and cement. We are exposing them to molding, sintering, casting, laminating, kiln forming, and 3D printing of liquid-based substances to create new materials and structures for architecture. We also plan to use a variety of unconventional energy sources to create these new materials including microwaves, lasers, and particle beams. We have an

interdisciplinary team of experts with interest and commitment to educational and research dimensions of this proposal.

Nazarian, S. Quarterly Report, 2014. Progress Report. (pp. 10).

Cited Research

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<http://www.chicagotribune.com/news/ct-met-nasa-mars-habitats-20171122-story.html>

Nazarian, Shadi. *Aerospace America, Publication of the American Institute of Aeronautics and Astronautics*. "Next Steps in Sustaining Human Presence in Space," The American Institute of Aeronautics and Astronautics, 2017. 69 and 72.
aerospaceamerica.aiaa.org/year-in-review/next-steps-in-sustaining-human-presence-in-space

Nazarian, Shadi. *President's Blog: Office of Strategic Communications*. "Raise the Song' in Praise of Our Tremendous Community and Our Successful University," University Park, PA: The Pennsylvania State University, 2017.
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Nazarian, Shadi. *Penn State News*. "Penn State Team Places Second in NASA 3D-Printed Habitat Challenge," The Pennsylvania State University, 2017.
news.psu.edu/story/480670/2017/09/05/research/penn-state-team-places-second-nasa-3d-printed-habitat-challenge

Nazarian, Shadi. *www.techcrunch.com*. "3D-printed space habitats earn \$400K in prizes at NASA competition," 2017. techcrunch.com/2017/08/29/3d-printed-space-habitats-earn-400k-in-prizes-at-nasa-competition/

Nazarian, Shadi. *www.plasticstoday.com*. "NASA promoting development of 3D-printing of outer space habitats from recyclable materials.," 2017.
www.plasticstoday.com/3d-printing/nasa-promoting-development-3d-printing-outer-space-habitats-recyclable-materials/21851985957403

Nazarian, Shadi. *www.nasa.gov*. "NASA Awards\$400,000 to top Teams at Second Phase of 3D-Printing Competition," 2017. www.nasa.gov/press-release/nasa-awards-400000-to-top-teams-at-second-phase-of-3d-printing-competition

Other Scholarly Publications

Nazarian, Shadi. *Speed Interchange*. *Intersight: Journal of School of Architecture and Planning, University at Buffalo* 10. (2007): 84-89.

Nazarian, Shadi. *Mutations*. *Intersight: Journal of School of Architecture and Planning, University at Buffalo* 8. (2005): 58-63.

Nazarian, Shadi. *Apertures in Motion*. *Intersight: Journal of School of Architecture and Planning, University at Buffalo* 7. (2004): 60-65.

Nazarian, Shadi. The Future of Permanence: Re-learning from Las Vegas. *Cornell Journal of Architecture* 7. (2003): 16-23.

Nazarian, Shadi. Thresholds: The Arcade Projects. *Center for Exploratory and Perceptual Art (CEPA) Journal.* (1998): 19-21.

Nazarian, Shadi. Search/Research. *Intersight: Journal of School of Architecture and Planning, University at Buffalo* 4. (1997): 68-75.

Nazarian, Shadi, and Mehrdad Hadighi. Chamber Theater Arts Center, Moscow. *Sites.* (1992): 72-77.

Hadighi, Mehrdad, and **Shadi Nazarian.** Three Projects. *Architectus.* (1992): 11-28.

Nazarian, Shadi and Mehrdad Hadighi. Peace Armor. *Landscape Architecture.* (1990).

IMPACTS ON SOCIETY (of Research Scholarship and Creative Accomplishment)

Including Media Mentions, Selected Broadcast Interviews

Book, Technics Improvised: Activating Touch in Global Media Art, on Digital Culture/Art, Written by Timothy Murray Director of Cornell Council for the Arts, University of Minnesota Press, Minneapolis, and London. (2022).

Cites **Nazarian, Shadi,** pp. XX, 94, 96-97, 167; work of, xxii, 95, 95 (fig.), 97

Interview, Designing Buildings for Mars: Building Sustainably on Mars and Earth, Internet, AccuWeather Chanel News, Park Forest, PA, NASA's 3D-Printed Habitat Challenge. Geoff Cornish discussed what buildings on Mars would look like to stand up to the challenges of colonizing the planet like with doctors José Duarte and Sven Bilén, the co-founders of AddCon Lab. The technology I had earlier developed and was included in Phase 3 of the NASA 3D -printed Mars Habitat Challenge Virtual Design Competition was introduced and discussed in this context. (January 28, 2022).

Interview, Penn State's 'From Earth to Mars and Back' exhibit explores future of innovative architecture, Newspaper, The Daily Collegian, University Park, PA, Penn State AddCon Lab. (December 9, 2021).

The Daily Collegian: Independently published by students at Penn State, Colton Lucas, **interviewed** me and another colleague on our exhibit that is on display at the Willard G. Rouse Gallery in the Stuckeman Family Building through January 19th, 2021. We discussed the exhibit titled *From Earth to Mars and Back*, and our team's interdisciplinary research on creation of sustainable materials and efficient terrestrial and extraterrestrial housing through three 3D printing technologies.

Internet, Penn State Researchers, Fingerprint, Research output, <pennstate.pure.elsevier.com> This website is updated on regular basis and indicate research activity and output per year. (November 8, 2021).

Fellows Directory, New York Foundation for the Arts Directory of Artists' Fellows & Finalists, Journal or Magazine, Fellowship Award in the category of Architecture / Environmental Structures, New York, NYFA. This is Directory Book of fellows awarded with the New York Foundation for the Arts (NYFA) in every category. I am listed in the Fellows Directory because I won a NYFA Fellowship in the year 2000 (Peer Reviewed) with a \$7000 cash award for submission of "Thresholds, The Arcade

Project". (2021)

Interview (on the Internet), The 'Space Architects' of Mars | The Age of A.I., Age of A.I. (film series on artificial intelligence.), Network Entertainment, Ransom, Rachael and Kirbyson, Rob (Segment producer and narrator). (January 15, 2020).

Interview, "3D Printing and Affordable Housing," Podcast, WPSU _REACH, University Park, Reach. (2020).

Online Video, including interviews with team members, Den@Mars The Competition, A WPSU Production, University Park, PA. (June 12, 2019). Available on YouTube < <https://www.youtube.com/watch?v=JITWINWHrsw>>

Article on the Internet, 3D-printed Mars habitat team has breakthrough, finishes second in NASA challenge, Penn State Research News, University Park, PA, Leon Valsechi. When the results of the third phase of NASA's 3D-Printed Mars Habitat Challenge were revealed in Peoria, Illinois, in early May, Penn State fell just short of besting its friendly rival AI SpaceFactory. But in the process, the team engineered a breakthrough that moves forward 3D-printing construction research and pushes the team closer to the goal of creating sustainable housing on Earth. (May 16, 2019).

Interview, Cosmic Front: On NASA 3D-Printed Mars Habitat Challenge, Television, NHK, the main public Japanese TV broadcaster. (March 28, 2019).

Article on the Internet, Penn State NASA challenge team advances, to be featured on Japanese TV, Penn State News. (January 19, 2019).

Article on the Internet, NHK, Japan's national public broadcasting organization, will be on the University Park campus Jan. 22 to film the Penn State interdisciplinary team that has advanced to the third phase of NASA's \$3.1-million 3D-Printed Habitat Challenge.

Article on the Internet, The PennStateDen@Mars team placed third in the Phase 3: Construction Level 2 of the 3D-Printed Habitat Challenge and brought home a prize of nearly \$84,000, as was announced Feb. 1 by NASA. For this level of the competition, six teams submitted 3D-printed samples that were tested for their ability to hold a seal, for strength and for durability in temperature extremes. There is one construction level remaining before the head-to-head competition in April.

Article on the Internet, Designing Sustainable Homes on Mars and Earth, One Community Impacting Many: Stories on Penn State's Impact, Penn State News. Penn State researchers are developing 3D-printed building technology that could be used for NASA's space exploration projects and impact the future of housing on Earth. (2019).

Notice of Technology Available for Licensing, Geopolymer-Based Ceramic and Glass Joints: Transitioning Interface from Glass to Geopolymer Cement, Penn State News Release to the Industry, Non-Confidential Description_ PSU Disclosure, Office of Technology Management- The Pennsylvania State University, The Patent Cooperation Treaty (PCT) International Publication Number WO 2017/181191 AI. Notice has gone out to the industry. (October 19, 2017).

The Daily Collegian, Penn State University Newspaper Article, BOT Shadi Nazarian, University Park, Shadi Nazarian, the faculty leader of the Penn State team in a NASA competition, speaks during first meeting of the academic year is held at the Penn State Hotel and Conference Center on Friday, Sept. 15, 2017. (September 15, 2017).

The Daily Collegian digital-newspapers, Penn State University Libraries

<https://libraries.psu.edu/collections>. The *Daily Collegian* and its predecessors serve as an important source for documenting student life at the Pennsylvania State University.

Breakfast with Homa Sarshar: Reflections on the News, Shadi Nazarian and her Interdisciplinary team succeed in NASA 3D Printed Habitat Challenge Competition.

Interviewed live by Homa Sarshar who addressed questions on the award my team earned on the NASA's 3D-Printed Habitat Challenge and related issues on my research. Aired on KIRN670AM Radio, Los Angeles, CA, <https://www.youtube.com/watch?v=Zb0rtxB4jUk>. (September 9, 2017).

NASA TV Livestream News, NASA Awards \$400,000 to Top Teams at Second Phase of 3D-Printing Competition, Television, NASA Institution of Aerospace: NASA News. (August 28, 2017).

NASA TV Livestream News, NASA 360: Behind the Scene, NASA's 3D Printed Habitat Challenge, A Centennial Challenge Competition, from Peoria, IL.

<https://livestream.com/viewnow/3dprintedhab>. (August 26, 2017).

MRI Website, Innovations: Seamless Architecture: Innovative Material Interfaces, Internet, Material Research Institute, University Park, PA, Our integrated research laboratories turn concepts into prototypes. This technology is developing simultaneously in three funded areas of focus: (1) the development of sustainable materials, processes, and practices; (2) providing solutions for building in harsh conditions where impermeability between and through surface materials is required; and (3) further development and modification of additive manufacturing technologies in the building industry and production of seamless architecture. (2016). (Also referenced under Exhibition Catalogue)

Nazarian, Shadi, and José Duarte. *Online*, edited by WPSU. "3D-Printed Habitat NASA Centennial Challenge: Phase two (Levels 1 and 2), and Phase 3 (Levels 1- though 5)," University Park: NASA and Penn State 3D-Printed Mars Habitat Challenge Competition Team, 2018. <https://www.youtube.com/watch?v=JITWINWHrsw> Co-directing the production of several videos for submission to the **3D-Printed Habitat NASA Centennial Challenge: Phase two (Levels 1 and 2), and Phase 3 (Levels 1- though 5)** Penn State Virtual Construction Level 2_BIM Design, which shows our Mars Design and printing simulation; 3D Printed Mars Habitat Challenge Phase 3 - Penn State - Construction Level 3 - 4D Simulation, which simulates what we will do at the current phase of the competition.

Shadi Nazarian and Jose Duarte. *3D Printing and Affordable Housing.* Penn State Virtual Construction Level 2_BIM Design, which shows our Mars Design and printing simulation. <<https://wpsu.psu.edu/digital/reach-podcast/developing-countries/>> (2020)

Nazarian, Shadi, Christopher Romano, and Nicholas Bruscia. *The Living Wall.*

The Blog presents an experiment in teaching fundamental architectural design studios (2nd-semester) at the University at Buffalo where we effectively delivered a microcosm of architectural practice from conception of ideas through realization addressing a wide spectrum of issues relating to building materials, construction, and the collaborative nature of our discipline. <http://thelivingwall.blogspot.com/2010/?m=0>

Bruscia, Nicholas, **Shadi Nazarian,** and Christopher Romano. *The Living Wall.* 2010. <http://thelivingwall.blogspot.com/>

PUBLIC LECTURES AND PRESENTATIONS

International

Nazarian, S. Design of Functionally Graded Structures at Voxel Scale, **Invited Plenary Speaker** at GECMSN23 (Upcoming, May 26th, 2023)

Nazarian, S. Graduation Leadership Story, **Speaker**, Online Webinar organized by Next Level Leadership, Inc. (June 21, 2022)

Nazarian, S. 3D-Printing Concrete Structures: NASA Challenge, Research, Industry Sponsorship, and Impacts. An AIA Approved Presentation at Connections, 83rd Annual Conference & Design Expo., El Paso, TX. (October 27-29, 2022).

Nazarian, S. Impacts and application of NASA's 3D Printed Habitat Challenge for Mars on Earth, **Speaker/ Presenter**, Symposium at the National Center for Education and Research on Corrosion and Materials Performance (NCERCAMP), National Concrete & Corrosion Symposium - Net Zero, Presenter, Elected, Served Ex-Officio, International. This was an AIA accredited lectures by NCERCAMP towards "Net Zero" to Make attendees aware of new technologies and important achievements in cement and construction sciences. (January 19, 2021).

Nazarian, S. Sustainability - From Buzzword to Guiding Principle, *Berlin Talks at Freie Universität Berlin, Freie Universität Berlin*, Online, 322 in attendance, Invited. International. <https://www.youtube.com/watch?v=pO0W5ksqWF8>. The use of "Sustainability" while referring necessity of efficient practices in use of natural and renewable resources has proliferated extensively and turned the concept into a buzzword. This discussion provided perspectives ranging from local/institutional, to the pursuit of business, the perspective of politics and policy-making, and citizen involvement. (February 19, 2021).

Nazarian, S. Impact of 3D-Printing Technologies on The Language of Architecture, 3D Printing Technology and Research World Forum 2020, Continuum Forums: Scientific Conferences, Toronto, Canada, peer-reviewed/refereed, Invited. International. <https://www.continuumforums.com/3d-technology-2020/speakers.php> The event was meant to be a platform for a critical and informative dialogue between researchers and industry players in this field and was to include high-ranking speeches from participants., but unfortunately cancelled due to the pandemic. (October 22, 2020 - October 23, 2020/ Cancelled due to the Pandemic)

Nazarian, S. An Architectural Paradox: Mingling of Independence and Dominance Presented by Additive Construction, Global Congress and Expo on Advances in 3D Printing & Modeling, Scientific Federation: Abode for Researchers, Global Congress and Expo on Advances in 3D Printing & Modeling, peer-reviewed/refereed, Invited. International. <https://scientificfederation.org/> (May 7, 2020 - May 8, 2020/ Cancelled due to the Pandemic).

Nazarian, S. An Overview of the Execution of 3D-Printed Subscale Habitat on Mars: A Case Study to Exemplify the Automated Construction Process, 5th Residential Building Design & Construction (RBDC 2020), Penn State University, University Park, PA, 350 in attendance, peer-reviewed/refereed, published in proceedings, Accepted. International. (April 2020)/ Cancelled due to the Pandemic).

Duarte, J.P, **Nazarian, S.** Architecture in the Age of Additive Manufacturing, Faculty Lecture Series, Department of Architecture, Penn State, October 4, 2019.

Nazarian, S. together with Fiske, M. of NASA, Invited Dialogue between speakers at a symposium on 3D Printing at Architectural Scale, Development of 3D Printing of Concrete at Architectural Scale, Exhibition of poster and videos, University of Michigan, Taubman College of Architecture and Urban Planning., Ann Arbor, Michigan. (October 31, 2019).

Nazarian, S. An Interplay between Materials, Systems, and Design, Public Lecture and Panelist, In the context of Conference on Automation Innovation in Construction, on Sustainability and Automation in Smart Construction. Organized by the faculty of Polytechnic of Leiria, in Leiria, Portugal (November 7th, 2019, 100 in attendance)

Nazarian, S. Transitional and Graded Interface Between Geopolymer Concrete & Glass. Invited Speaker Online Lecture, GECMSE and American Elements: The Advanced Materials Manufacturers, Rome, Italy. (June 18, 2022, 800 in attendance)

Regional

Nazarian, S. Additive construction of Concrete Structures: 3D Concrete Printing (3dCP), Invited Speaker and Panelist, Technology from the Next Generation's Perspective Panel, ABC CPA TECH EXPO, invited by president of Association of Builders and Contractors (ABC) – Central Pennsylvania. (April 1, 2022)

Nazarian, S. Additive Manufacturing of Concrete Structures, inaugural *Penn State Industry Innovation Summit*, **Invited Speaker**, Senior Vice President for Research at Penn State, Office of Industrial Partnership. The purpose of the summit is to have faculty and staff across the University's innovation ecosystem engage with industry leaders to learn how to better partner with industry to co-create world-changing innovations. (February 15, 2022)

Penn State- Official

Invited

Nazarian, S. Frontiers in Glass Science and Technology, Invited Speaker by Head of the Department of Material Science and Engineering to speak in a session honoring Dr. Arun Varshneya at the 2023 Taylor Lecture Symposium at Penn State University, (Upcoming, April 20, 2023)

Nazarian, S. Additive Construction Laboratory and 3D Concrete Printing at Penn State, Invited Speaker to speak at the spring 2022 seminar series *Additive at Penn State*, Open to 118 industry practitioners enrolled from more than 80 different companies in the Additive Manufacturing and Design Graduate Programs, resident master's program. (April 26, 2021)

Nazarian, S. NASA 3D-Printed Habitat Challenge Competition, Invited Speaker, to address the Board of Trustees, by Dr. Eric Barron, President, of The Pennsylvania State University, University Park, PA. (September 15, 2017).

Nazarian, S. Seamless Architecture, Invited Speaker at the Material Research Institute's Millennium Café lecture series, Material Research Institute, University Park, PA, Invited. (March 28, 2017).

Note: Lectures given at conferences where articles or abstracts have been submitted are included in the publications.

SERVICE TO THE UNIVERSITY and SUPPORT OF SCIENTIFIC ACTIVITY

Service to the Discipline Including Scientific Committees of Exhibitions (International)

ARCC, Architectural Research Centers Consortium. Article Reviewer Feb. 2023

ARCC, Architectural Research Centers Consortium. Abstract Reviewer July 2022

Active Participation in or Service to Professional and Learned Societies:

Journal of Architectural Engineering, Peer reviewer of journal articles, <https://www.researchgate.net/journal/Journal-of-Architectural-Engineering-1076-0431> (July 2017 – Present)

Architectural Research Centers Consortium (ARCC), The double-blind peer reviewer of abstracts and review of papers. Theme: The Research-Design Interface, (July 15, 2022 - January 15, 2023). <http://www.arcc-arch.org/arcc-2023/>

Scientific Committee of the Sustainable and Digital Building conference, Committee Member, (November 12, 2021 - October 28, 2022). <https://sdb.ipleiria.pt/>

Construction & Building Materials, Peer Reviewer (2020 - 2021). <https://service.elsevier.com/app/home/supporthub/publishing/>

Universität Liechtenstein, in Liechtenstein

Erasmus Code: LI VADUZ01. I participated by invitation from the Universität Liechtenstein in the Staff Mobility Program. Role: Visiting Critic . (June 26, 2017 - June 30, 2017).

Texas Tech University, College of Architecture, served as a guest critic., (May 2020).

Provided Internship, Transitional Material Interface Lab, Penn State University, A Rhode Island School of Design student requested a summer internship to apply her skills in cold-working, mold-making, lost-wax, and glass-casting to research on seamless transition from concrete to glass. (June 1, 2016 - June 30, 2016).

Architecture & Urbanism in The Mediterranean & The Middle East. *International Symposium and Architectural Projects Exhibition- Contemporary Architecture & Urbanism in The Mediterranean & The Middle East"*. organized by Bahçeşehir University in Istanbul, Turkey. Role: Served as a member of Scientific Committee of the CAUMME PAUMME by invitation, to provide scientific evaluation of papers submitted to the International Symposium and Architectural Projects Exhibition. (2017 – 2018)

Service to PSU, College of Arts & Architecture, & Stuckeman School

Additive Construction Research laboratory, Co-Founder and Co-Director, Collaborative Interdisciplinary Research, Penn State. The aim of this multi-disciplinary project is to develop the technology to 3D print architectural structures, to enable the materialization of mass customized affordable housing. It explores two lines of research related to concrete- and clay-based mixtures and it addresses a multitude of issues concerning the design of materials, printing system, toolpath, structure, and building. (2020 - Present).

The Stuckeman School Alumni Association Dissertation Award. Role: Evaluator, ranking of the nomination packages submitted by the PhD candidates being considered for the AADA. (September 11, 2022 - September 14, 2022)

Served as team-leader in the NASA 3D-Printed Mars Habitat Challenge Competition.

Role: Team leader, Penn State Team (Penn State Den@ Mars), Co-Organizer, Elected. Correspondence with the NASA Centennial Challenge organizers facilitating contracts between them and Penn-State Risk-Management office, collecting sharing required documentation, preparation and submission of reports, coordination of various team members' tasks. (February 2017 - June 2019).

Schreyer Honors College's Faculty Selection Committee for admissions

(2016 - 2021).

Elected member of College of Arts and Architecture Faculty Council, a governance body, College of Arts and Architecture Faculty Council, Representative, Elected. (2016 - 2018).

College of A&A Non-Tenure-Track Faculty Promotion Committee. Role: Chairperson. (January 2018 - April 2020).

Contribution to the Advisory Board Agenda, Stuckeman School, Contributor. Was invited by the school director to join with a select group of faculty whom they felt have valuable contributions for discussions with the Stuckeman Advisory Board (November 10, 2016).

Participation in Development, Representing Department of Architecture, Development, Center for Arts Pedagogy, Contributor. (November 2015 - 2016).

Facilities Committee, College of Arts and Architecture. Role: Member. (August 2015 - May 2017).

Faculty Search Committee member. Role: Committee Member. (2021 - 2023)

Promotion and Tenure Committee for Fixed Term Faculty. Role: Chair (2021-2022)

Admissions Committee: Graduate, Undergraduate, and evaluating and ranking the PhD candidate for incoming and transferring students, Role :Committee Member. (January 2012 - Present).

Curriculum Committee. Role: Committee Member. (2012 - 2013).

Served as a panel moderator at the conference *ARCINTEX*, Proposals for Other Worlds, Architectures, Materials, Interactions, Moderator, Served Ex-Officio, International. (April 7, 2022 - April 8, 2022). <https://sites.psu.edu/arcintex/>

**Service to the
Department of
Architecture**

PATENTS AND REGISTRATIONS

Patent pending United States Provisional Application No. 63/041,394 filed June 19, 2020, **Reinforced Composite Materials and Methods of Making the Same**, Inventors: Ali Memari, Maryam Hojati, José Duarte, **Shadi Nazarian**, Aleksandra Radlińska, Sven Bilén, Nick Meisel.

Patent pending United States Provisional Application No. United States Provisional Application No. 63/041,351 filed June 19, 2020, **Concrete Mixture for 3D Printing**, Inventors: Ali Memari, Maryam Hojati, José Duarte, **Shadi Nazarian**, Aleksandra Radlińska, Sven Bilén, Nick Meisel.

Invention Disclosure no. 2020-5121 of June 1, 2020. **Method for the Additive Manufacturing of Raised Slabs**, Inventors: Nate Watson, Sven Bilén, José Duarte, **Shadi Nazarian**, Ali Memari, Nick Meisel, Aleksandra Radlińska, Randall Bock.

Invention Disclosure no. 2019-5004 of October 16, 2019. **Innovative Reinforcement for 3D Printing of Concrete**, Inventors: Ali Memari, Maryam Hojati, José Duarte, **Shadi Nazarian**, Aleksandra Radlińska, Sven Bilén, Nick Meisel.

Invention Disclosure no. 2019-5003 of October 16, 2019. **Concrete Mixture for 3D Printing**, Inventors: Ali Memari, Maryam Hojati, José Duarte, **Shadi Nazarian**, Aleksandra Radlińska, Sven Bilén, Nick Meisel.

Patent pending United States Provisional Application no. [PSU 20174699, 36PST92501P1, filed on November 22, 2017], **MarsCrete TM: Tailored Dry Geopolymer Binder**, Inventors: Maryam Hojati, **Shadi Nazarian**, Jose Duarte, Aleksandra Radlinska, Ali Memari, Sven Bilén.

Patent Issued: U.S. Patent No.11,414,345; **Seamless And Impermeable Joints Resulting In A Functionally Graded Material: Transitioning From Glass To Geopolymer Mortar**, Inventors: **Shadi Nazarian**, Carlo Pantano, Paolo Colombo, Mauro Marangoni.

ARCHITECTURAL PROJECTS AND COMPETITION ENTRIES

Studio For Architecture

Bryn Mawr Pool House Renovation

2019

An In-Law Suite has been designed as a renovation and addition to an existing pool-house situated in close proximity to the existing house in Bryn Mawr, PA.

Scope: Design and developments of the house, details between existing slab and new construction, and preparation of all drawings and renderings.

Site: a 3-acre site in Bryn Mawr, PA

Gross Floor Area: 670 square feet.

Budget: \$150,000 budget.

Status: Out to bid, not yet built.

Rock-Up House, Collaboration with Mehrdad Hadighi. 2010-2012

A weekend house in the Cattaraugus Mountains of New York, situated on a heavily wooded site with mature trees, and a seasonal creek. The necessity for a septic system, and the slope of the site away from the septic, in addition to budget constraints and the desire to locate the house near the creek and not cut any trees have conjured the invention of a new method of constructing the foundation and the main slab: rock-up. It is a combination of tilt-up and lift-slab construction methods.

Scope: Design and Construction Documents, Not built.

Site: 4-acre site in the Cattaraugus Mountains of Western New York;

Gross floor area: 1,200 SF

Budget: \$200,000

Boulos Residence, Assisted Mehrdad Hadighi 1998

Situated in Medina N.Y, on Erie Canal. Scope: 6000 square feet. \$370,000 budget.

Assisted in preparing construction drawings.

Competitions

The Austrian Cultural Institute 1992

Collaboration with Mehrdad Hadighi, and Wolfgang Tschapeller.

A proposal for the "Austrian Cultural Institute", which questioned the relationship of real estate value and cultural values in a mid-town Manhattan 30-story tower. The proposal consciously subverted the relationship of rentable space and public cultural spaces. The core, the most identifiable, vertically continuous, structurally stable, and programmatically singular center of high-rise construction is taken apart, sliced vertically, multiplied, and re-assembled to make the building the core, and the core the building.

Scope: Competition entry, including drawings, models, codes, & calculations.

Site: 25' wide row-house site, 11 W. 52nd Street, New York, NY

Gross floor area: 28,220 SF

"Fifth Place Prize", in "Austrian Cultural Institute" national design competition.

Cemetery Chapel 1998

Ralph Rapson Traveling Fellowship competitions- Sponsored by the Minnesota Architectural Foundation and the College of Architecture and Landscape Architecture.

The San Francisco Prize 1997

An architectural landscape proposal for the San Francisco Union Square. Explored a mixed media process and presentation techniques.

Scope: Preliminary Design, a model and drawings of the proposed design completed

NNARA/TOTO 1992

World Architecture Triennial. Proposal for "Architecture with hetero-cultural fusion as its goal".

Scope: Conceptual project- model

Frame/ Center 1991

Collaborative project with M Behrooz, M Hadighi, J Zissovici.

The proposal for the "Ulug-Beg Cultural Center" design competition examined the relationship between physical, geometric centers, cultural, and urban centers. It proposed a building/ landscape/frame as a neutral device to bring together many independent centers.

Scope: Competition entry, with urban and architectural drawings, & models.

Site: 30 acres in the urban center of Samarkand, Uzbekistan
 Gross floor area of proposed buildings: 300,000 SF
 Budget: \$53 Million
REALtheaTER 1990
 Collaborative project with M Hadighi, and Z Zainul.
 A proposal for the “Moscow Chamber Theater Arts Competition”. The design was based on the construction of the threshold between theatricality and reality, the actual and virtual, as the theatre building.
 Scope: Proposed architectural design drawings, and models completed.
 Site: 9 acres in Hermitage Gardens in Moscow
 Gross Floor area: 39,600 SF
 Budget: \$5.9 Million
Peace Armor 1989-1990
 Collaborative project with M Hadighi.
 A proposal for the “Peace Garden International Design Competition”, questioning the possibility of a meaningful representation of peace on a site surrounded by military installations at the dawn of the 21st century, a moment defined by a state of perpetual political tension and unrest.
 Scope: Competition entry, architectural design drawings, and models.
 Site: Haines Point in Potomac Park, Washington, D.C.,
 Construction area: 160,000 SF
 Budget: \$14 Million
Projects for Liquid Cities 1989-1990
 Collaboration with M Hadighi.
 A project, which emerged from a research of the city as a liquid state (political, economic, and tectonic), where entities are inseparable from their flows, and flux is reality itself, exhausting the solid states.
 Scope: Conceptual project, drawings, and models
A Monument for the Twin Cities 1989
 Collaborative project with M Hadighi.
 A proposal for a monument for Minneapolis/St. Paul, constructed as a multi-media information network presenting simultaneously unrelated events, found images, and news material of scattered sources of a metropolitan area.
 Scope: Ideas competition, limited to conceptual drawings and models.
 Gross floor area: 8400 SF
Terminal City 1989
 Collaborative project with M Hadighi
 A proposal for the “High Speed Motor Terminal Competition”. The terminal is proposed as the city of interchange, a circuit of movement and activity.
 Scope: Ideas competition, limited to conceptual drawings and models. Site: NYC.
Animated Constructs.....1989
 Collaborative project with M Hadighi.
 A proposal for the “Yokohama Urban Design Competition”, to construct cities and their architecture as superimpositions of layers of animated and programmed activity.

Scope: Ideas competition, limited to conceptual drawings and models.
Site: 10,000 square feet on Basha-Michi Mall, central Yokohama, Japan
The Cultivation of a Fortuitous Cut in the Ocean 1988-89

Collaborative project with M Hadighi.

A proposal for the “Competition Diomede”, to exhaust the notion of boundaries of cultures, nations, and races through the exhaustive multiplicity of those boundaries.

Scope: Ideas competition, limited to conceptual drawings and models.

Site: The Diomede Islands, on the border between Alaska and Russia

As Freelancer

Design Work

1100 Architects, New York, NY 1989
Architectural Designer; Worked on design and development of residential projects and presentation drawings for “*NY Architects*” exhibition in Frankfurt Museum.

As Employee

Pei Cob, Freed, San Francisco Public Library 1981-1991
Main task: Working closely with James Ingo Freed on the design team: (a) started with precedent analysis focused on Saitek-Geneviève Library– on the Grounds of the University of Paris in France, (b) conceptual development and introduction of the public atrium and monumental stairs, and (c) development of the exterior envelope. Site is located in the Civic Center of San Francisco. Construction Completed in 1996.

Pei Cob, Freed, Ronal Reagan Building, The Federal Triangle 1980-1981
Between 15th Street NW, Constitution Avenue NW, Pennsylvania Avenue NW, and E Street NW, in Washington, D.C. Main task: development of the exterior envelope.

Demjanec & Wilson Architects, Ithaca, NY 1987-89
Design and development of residential projects

EXHIBITIONS

Invited Exhibits

Nazarian, Shadi, and Duarte, José, P. From Earth to Mars and Back, As a part of the *Over and Over Again* Exhibit. 3D-Printed Concrete Structures exploring the affordances of Additive Construction produced by the students in the Directed Research Studio guided by AddCon Research Lab Faculty, Nazarian and Duarte, exhibited at the Hub Robeson Galleries, University Park, PA, 16802, USA, by Invitation, Academic. <https://youtu.be/LhBOc-MZe-8>
‘Over & Over Again’ exhibition bridges gap between science, art at Penn State’s HUB Galleries. Exhibit highlights the multidisciplinary work of AddCon Lab researchers, and their Directed Research Studio produce wards sustainable housing solutions on Earth and beyond by using 3D printing processes. Invited Exhibition, at Hub-Robertson Galleries, University Park, PA (July 22, 2022 - September 4, 2022)

Nazarian, Shadi; Duarte, José; and Ashrafi, Negar. From Earth to Mars and Back: Additive Manufacturing of Concrete Structures, This invited exhibition included 3D Printed Concrete Structures produced by students in a Directed Research Studio taught by Nazarian and Duarte, co-founders, and members of the AddCon Laboratory- Showcasing works produced by 3D concrete printing at construction-scale to create sustainable housing options that could

revolutionize construction industry and address larger societal issues, such as homelessness. The exhibit builds on our NASA 3D-Printed Mars Habitat Challenge Competition, where we finished second, also features undergraduate and graduate students' works.

Location: The Willard G. Rouse Gallery, Stuckeman School's Lecture and Exhibit Space. Department of Architecture, University Park, Pennsylvania, by Invitation, Academic. (November 3, 2021 - January 19, 2022).
<https://arts.psu.edu/facilities/rouse-gallery/>

Nazarian, Shadi; Pinto Duarte, Jose; Kumar, Naveen; and Ashrafi, Negar. Penn State's entry for NASA's Virtual Design and Construction of the proposed Habitat for MARS in Phase 3- Level 2. This Building Information Model (BIM) in a VR Environment was sponsored by NASA, Caterpillar, and Bradley University. at Edwards Caterpillar Exhibition and Learning Center. Juried, at NASA 3D Printed Habitat Challenge Virtual Design Competition, Peoria, IL, selected, and invited by Competition Jury. (May 5, 2019 - May 29, 2019).

Nazarian, Shadi. Innovative competition Entries by Penn State Team: MarsCrete™ and Phase II, Structural Member Competition, at *World of Concrete Convention, Las Vegas, NV, USA*, by Invitation, Non-Academic. Exhibited interdisciplinary research, accomplishments, and innovations in two areas that "highlight new and innovative technologies that impact the construction industry": (a) the development of new types and mixtures of printable concrete with low ecological footprint, and (b) in the area of new technologies of Additive Manufacturing (3D Printing) of concrete structural members. (January 23, 2018 - January 26, 2018).

Nazarian, Shadi. Inaugural Exhibition of 3D Printed works from Across Penn State University, Included in the *Penn State 3D Printing Showcase: An Inaugural Exhibition of 3D Printed works from Across Penn State University.* 3D-Printed works: Concrete, Clay, and other materials were exhibited at this Invited Group Exhibition, The Pennsylvania State University, University Park, PA, USA, by Invitation, Academic. (2017).

**Site-Specific
Exhibition,
Invitational/ Solo**

Nazarian, Shadi. Introversions, invited site-specific installation at The Center for the Arts, Lightwell Gallery, UB Art Gallery, Center for the Arts, Buffalo, NY 14260. Sponsored in part by grants from the New York State Council on the Arts and New York Foundation for the Arts special opportunity stipends. Additional support by: KNEMA, LLC, Polytonic, Inc. and SMG HARSON. (February 28, 2008 - May 17, 2008)
<https://www.buffalo.edu/art-galleries/exhibitions/2008/Nazarian.html>

Nazarian, Shadi. Thresholds: The Arcade Projects, Buffalo, NY, USA. Multi-media site-specific solo installation in the context of "Ruin in Reverse: Time and Progress in Contemporary Art" at The Center for Exploratory and Perceptual Arts, CEPA Gallery. (December 1999- May 2000).

Nazarian, Shadi. Space of Locomotion. Invited exhibition at *Recent Works: Faculty Research Showcase*, at the Borland Project Space, University Park, PA, USA, by Invitation. (2008).

Nazarian, Shadi. Space of Locomotion. Invited exhibition as a part of *Situated*

Technologies Research Group Exhibit, at Dett Gallery, Hayes Hall, State University of New York at Buffalo, Buffalo, NY, USA, by Invitation. (2004).

Nazarian, Shadi. Exploring Disciplines/Thresholds: interactive digital presentation, Cornell University, College of Architecture, Art and Planning, Ithaca, NY, USA, by Invitation. (2000).

Nazarian, Shadi. Space of Locomotion: Iris Print of Digital Scroll-Painting, Ground Zero, Center for Exploratory and Perceptual Arts, CEPA Gallery, Buffalo, NY, USA, by Invitation. (2000).
Also, on Auction Preview on April 14 – May 6, 2000

Nazarian, Shadi. Interviews, C Hartell Gallery, Cornell University, Ithaca, NY, USA, by Invitation. (1999).
The multi-media/hybrid installation enabled multiple projects to interconnect within a larger apparatus, at the Hartell Gallery, Cornell University. The Gallery became a laboratory/test ground in the duration of the installation. An apparatus called "Building/Machines" was designed and built collaboratively to link all the projects. This collaborative effort was funded by the Cornell Council for the Arts and presented to the public

Nazarian, Shadi. Simultaneous Spaces, James Dyett Gallery, University at Buffalo, Buffalo, NY, USA, by Invitation. (1998).

Nazarian, Shadi. Space of Locomotion, Atelier 97, State University of New York at Buffalo, Buffalo, NY, USA, by Invitation. (1997).
Full-scale video installation

Nazarian, Shadi, and Hadighi, M. Competition Entry: The Austrian Cultural Institute, Hartell Gallery, Cornell University College of Architecture Art and Planning, Ithaca, NY, USA, by Invitation. (1993). Group exhibit of "Female Constructs"

Exhibition,

Selected/ Competitive

Nazarian, Shadi. Window Walking II, Main Street Art Street: The Windows Project, Buffalo, NY, USA, by Competition. (1999).

Nazarian, Shadi. Window Walking, Main Street Art Street: The Windows Project, Buffalo, NY, USA, by Competition. (1998).

Exhibition,

Invited Group Exhibit

Nazarian, Shadi. (a) Presentation of Representation, (b) The Interface: Scanning Electron Microscopy of a physical sample. at *Works On/Off Paper*.
Description(a): A composite digital painting, based on an 1887 motion-study photographic plate of Eadweard Muybridge, launched a series of spatial studies -Structuralist Activities- using intersecting layers of analogue and digital media.
Description (b): The modulations, the controlled distribution and variation of the Functionally Graded Material composed of geopolymer concrete and glass; enabling the seamless and graded transition from total optical transparency to structural concrete in response to programmatic and functional needs; making possible novel architectural interfaces, details, and spatial experiences; denoting transforming language of architecture..... bit by bit.
Location: Willard Rouse Gallery, Stuckeman Family Building, University Park,

PA. (December 2, 2019 - June 15, 2020)

[. https://news.psu.edu/story/600331/2019/12/02/academics/architecture-facultys-work-processes-highlighted-stuckeman-school](https://news.psu.edu/story/600331/2019/12/02/academics/architecture-facultys-work-processes-highlighted-stuckeman-school)

- Nazarian, Shadi**, and Hadighi, M. Culture/Vulture, University of Minnesota College of Design, Minneapolis, MN, USA, peer-reviewed/refereed. (1996).
- Nazarian, Shadi**, and Hadighi, M. Frame/Center, University of Minnesota College of Design, Minneapolis, MN, USA, peer-reviewed/refereed. (1996).
- Nazarian, Shadi**, and Hadighi, M. Pease Armor, University of Minnesota College of Design, Minneapolis, MN, USA, peer-reviewed/refereed. (1996).
- Nazarian, Shadi**, and Hadighi, M. Culture/Vulture, McGill University, Montreal, Canada, peer-reviewed/refereed. (1995).
- Nazarian, Shadi**, and Hadighi, M. Culture/Vulture, Syracuse University, Syracuse, NY, USA, peer-reviewed/refereed. (1995).
- Nazarian, Shadi**, and Hadighi, M. Culture/Vulture, Austrian Federal Ministry for Foreign Affairs, Wien, Austria, peer-reviewed/refereed. (1995).
- Nazarian, Shadi**, and Hadighi, M. Culture/Vulture, Graham Foundation, Chicago, IL, USA, peer-reviewed/refereed. (1994).
- Nazarian, Shadi**, and Hadighi, M. Culture/Vulture, Austrian Federal Ministry of Foreign Affairs, Wien, Austria, peer-reviewed/refereed. (1993).
- Nazarian, Shadi**, and Hadighi, M. Culture/Vulture, Architectural League, New York, NY, USA, peer-reviewed/refereed. (1993).
- Nazarian, Shadi**, and Hadighi, M. Frame/Center, Aga-Khan Center, Geneva, Switzerland, peer-reviewed/refereed. (1992).
- Nazarian, Shadi**, and Hadighi, M. Frame/Center, Samarkand Cultural Center, Samarkand, Russian Republic, peer-reviewed/refereed. (1992).
- Nazarian, Shadi**, and Hadighi, M. Liquid Cities, Wallach Art Gallery, Columbia University, New York, NY, USA, peer-reviewed/refereed. (1991).
- Nazarian, Shadi**, and Hadighi, M. Pease Armor, Rensselaer Polytechnic Institute, Troy, NY, USA, peer-reviewed/refereed. (1991).
- Nazarian, Shadi**, and Hadighi, M. Pease Armor, University of Texas at Arlington, Arlington, TX, peer-reviewed/refereed. (1991).
- Nazarian, Shadi**, and Hadighi, M. Pease Armor, Pennsylvania State University, University Park, PA, USA, peer-reviewed/refereed. (1990).
- Nazarian, Shadi**, and Hadighi, M. Pease Armor, Howard University, Washington, DC, USA, peer-reviewed/refereed. (1990).
- Nazarian, Shadi**, and Hadighi, M. Pease Armor, N.I.A.E. Gallery, New York, NY, USA, peer-reviewed/refereed. (1990).
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