MAHA N. HAJI

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ACADEMIC APPOINTMENTS

Assistant Professor of Mechanical and Systems Engineering incoming July 2021
Sibley School of Mechanical and Aerospace Engineering, Cornell University

Faculty Fellow Aug 2019 – June 2021
Sibley School of Mechanical and Aerospace Engineering, Cornell University

Postdoctoral Research Associate Aug 2019 – June 2021
Engineering Systems Laboratory, Department of Aeronautics and Astronautics, Massachusetts Institute of Technology

Postdoctoral Research Associate June – Dec 2017
Precision Engineering Research Group Department of Mechanical Engineering, Massachusetts Institute of Technology

RESEARCH INTERESTS

Offshore Structure and System Design, Ocean Resource Extraction, Sustainability, Systems Engineering and Architecture, Engineering Design, Design Optimization, Multidisciplinary and Multi-Objective Optimization, Agent-Based Modeling, Model-Based Systems Engineering.

TEACHING INTERESTS

Engineering Design, Offshore Structure Design, Ocean Vehicle Design, Design Optimization, Systems Engineering, Systems Architecture.

EDUCATION

Massachusetts Institute of Technology and
Woods Hole Oceanographic Institution
Ph.D., Mechanical and Oceanographic Engineering June 2017
Dissertation: *Extraction of Uranium from Seawater: Design and Testing of a Symbiotic System*
Advisor: Prof. Alexander H. Slocum

M.S. Oceanographic Engineering Feb 2015

University of California, Berkeley May 2012
B.S., Mechanical Engineering
B.A., Applied Math

INDUSTRY EXPERIENCE

ATA Engineering – Project Engineer (Huntsville, AL & Austin, TX) Feb 2018 – Aug 2019
- Designing and fabricating rotor testing lab for measurement of critical rotorcraft dynamics.
- Developing novel, adaptable, portable gravity offloader robot as part of Phase I NASA SBIR.
- Applying machine learning to complex mechanical system simulations for Phase II Navy SBIR.
- Conducted design analysis of large themed rides, including ride profile loads and fatigue life.
- Worked on teams to author and review multiple SBIR/STTR proposals for NASA and DoD.

Flight Infinity – Co-Founder (Cambridge, MA) 2017 – 2018
- Designed waterproof electronics cage for autonomous, wind-powered drone.
- Selected as one of the 500 Deep-Tech Startups showcased at Hello Tomorrow in Paris, France.
- Raised $15,000 in non-dilutive seed capital from the MIT Sandbox Innovation Fund.

IDEO CoLab – Winter Fellow (Cambridge, MA) Jan 2017
- Rapidly prototyped the viability of several startup ventures centered around Internet Of Things.
- Collaborated with team to develop products in food, home appliances, and productivity.

California Wave Power Technologies – Team Member (Berkeley, CA) 2013 – 2016
- Developed detailed business plans and performed market analysis for wave energy startup.
- Conducted global technical site analysis and evaluated impact on levelized cost of electricity.
- Team selected as part of first cohort of Cyclotron Road hardware incubator at Berkeley Lab.
- Featured on ASME.org News, ASME ISHOW, and Bloomberg Businessweek.

UC Berkeley Physical Plant and Campus Services – Designer (Berkeley, CA) 2009 – 2013

- Designed new campus recycling bins that decrease cross-stream contamination by 70%.
- Collaborated closely with campus administrators, including Landscape Architect.
- Recycling bins deployed across campus as of Spring 2013.
- Featured on Berkeley News and The Daily Californian.

JOURNAL PUBLICATIONS

[7] **M. N. Haji,** and A. H. Slocum, "An offshore solution to cobalt shortages via adsorption-based harvesting from seawater," *Renewable & Sustainable Energy Reviews*, **105**, 301-309, 2019.

[6] **M. N. Haji,** J. Drysdale, K. Buesseler, and A. H. Slocum, "Results of an Ocean Trial of the Symbiotic Machine for Ocean uRanium Extraction," *Environmental Science & Technology*, **53** (4), 2229-2237, 2019.

[5] **M. N. Haji**, J. Gonzalez, J. Drysdale, K. Buesseler, and A. H. Slocum, "Effects of Protective Shell Enclosures on Uranium Adsorbing Polymers" *Industrial & Engineering Chemistry Research*, **57** (45), 15534–15541, 2018.

[4] **M. N. Haji**, J. M. Kluger, T. P. Sapsis, and A. H. Slocum, "A Symbiotic Approach to the Design of Offshore Wind Turbines with Other Energy Harvesting Systems," *Ocean Engineering*, **169**, 673-681, 2018.

[3] M. E. Flicker Byers, **M. N. Haji,** A. H. Slocum, and E. Schneider, "Cost Optimization of a Symbiotic System to Harvest Uranium from Seawater via an Offshore Wind Turbine" *Ocean Engineering*, **169**, 227-241, 2018.

[2] **M. N. Haji,** J. M. Kluger, J. W. Carrus, T. P. Sapsis, and A. H. Slocum, "Experimental Investigation of Hydrodynamic Response of a Symbiotic Machine for Ocean Uranium Extraction combined with a Floating Wind Turbine," *International Journal of Offshore and Polar Engineering*, **28**(3):225-231, 2018.

[1] A. H. Slocum, **M. N. Haji**, A. Z. Trimble, M. Ferrera, and S. J. Ghaemsaidi, "Integrated Pumped Hydro Reverse Osmosis Systems," *Sustainable Energy Technologies and Assessments,* **18**:80-99, 2016.
Featured on MIT News.

PEER-REVIEWED CONFERENCE PUBLICATIONS

[13] **Maha N. Haji**, Jimmy Tran, Johannes Norheim, and Olivier L. de Weck, "Design and Testing of AUV Docking Modules for a Renewably Powered Offshore AUV Servicing Platform", *39th International Conference on Ocean*, Offshore & Arctic Engineering 2020 in Fort Lauderdale, FL, June 28-July 3, 2020 (accepted).

[12] L. W. Du and **M. N. Haji** "Following Diversity in a Student-Run Makerspace: Trends in gender, engagement, and usage," In *Proceedings of the 4th International Symposium on Academic Makerspaces*, 13, New Haven, CT, October 16-18, 2019

[11] **M. N. Haji** and M. Filippi "Academic makerspaces as preparation for careers in industry," In *Proceedings of the 3rd International Symposium on Academic Makerspaces,* 21, Stanford, CA, August 3-5, 2018.

[10] **M. N. Haji**, J. Drysdale, K. Buesseler, and A. H. Slocum, "Ocean Testing of a Symbiotic Device to Harvest Uranium from Seawater through the Use of Shell Enclosures", In *Proceedings of the Twenty-seventh (2017) International Ocean and Polar Engineering Conference*, 177-185, San Francisco, CA, June 25-30, 2017.

[9] **M. N. Haji,** M. E. Flicker Byers, E. A. Schneider, and A. H. Slocum, "Cost Analysis of Wind and Uranium from Seawater Acquisition symBiotic Infrastructure using Shell Enclosures", *Transactions of the American Nuclear Society*, **116**:89-92, 2017.

[8] K. Simon and **M. N. Haji,** "Building a safety-based culture for a student-run makerspace," In *Proceedings of the 1st International Symposium on Academic Makerspaces,* 108-110, Cambridge, MA, November 13-16, 2016.

[7] D. S. Dorsch, **M. N. Haji**, and J. C. Nation, "A hierarchical system for purchase management in a student-run makerspace," In *Proceedings of the 1st International Symposium on Academic Makerspaces,* 176-179, Cambridge, MA, November 13-16, 2016.

[6] **M. N. Haji,** N. Petelina, and K. Smyth "Building community around a student-run makerspace: Project-based social and educational events," In *Proceedings of the 1st International Symposium on Academic Makerspaces,* 41-44, Cambridge, MA, November 13-16, 2016.

[5] M. E. Flicker Byers, **M. N. Haji,** E. A. Schneider, and A. H. Slocum, "A Higher Fidelity Cost Analysis of Wind and Uranium from Seawater Acquisition SymBiotic Infrastructure", *Transactions of the American Nuclear Society*, **115**:271-274, 2016.

[4] **M. N. Haji,** A. H. Slocum, "Design of a Symbiotic Device to Harvest Uranium from Seawater through the use of Shell Enclosures", *Transactions of the American Nuclear Society,* **115**:153-156, 2016.

[3] **M. N. Haji,** C. Delmy, J. Gonzalez, A. H. Slocum, "Uranium extraction from seawater using adsorbent shell enclosures via a symbiotic offshore wind turbine device", In *Proceedings of the Twenty-sixth (2016) International Ocean and Polar Engineering Conference*, 562-569, Rhodes, Greece, June 26-July 1, 2016

Awarded **Best Student Paper** by the International Society of Offshore and Polar Engineers

[2] **M. N. Haji,** C. Vitry, and A. H. Slocum, "Decoupling the functional requirements of an adsorbent for harvesting uranium from seawater through the use of shell enclosures," *Transactions of the American Nuclear Society*, **113**:158-161, 2015.

[1] **M. N. Haji,** K. Lau, and A. Agogino, "Human Power Generation in Fitness Facilities," In *Proceedings of the ASME 2010 4th International Conference on Energy Sustainability,* ES2010-90915, Phoenix, AZ, May 17-22, 2010.

Featured on Berkeley Engineering News in 2010 and 2013.

Other Publications

[4] A. H. Slocum, **M. N. Haji,** J. Kluger, and A. Patel, "Offshore Platforms for Harvesting Renewable Energy and Minerals from Seawater," In *Proceedings of the Offshore Energy and Storage 2018 Conference*, Ningbo, China, July 4-6, 2018.

[3] **M. N. Haji,** J. Kluger, T. Sapsis, and A. H. Slocum, "A Symbiotic Approach to the Design of Offshore Wind Turbines with Other Energy Harvesting Systems," In *Proceedings of the Offshore Energy and Storage 2017 Conference*, Cape Cod, MA, July 11-14, 2017.

[2] A. H. Slocum, **M. N. Haji**, J. Kluger, and T. Sapsis, "Mechanics and materials in the design of symbiotic offshore energy harvesting systems," In *Proceedings of the 7th International Conference on Mechanics and Materials in Design*, Albufeira, Portugal, June 11-15, 2017.

[1] **M. N. Haji,** K. Lau, and A. Agogino, "Harnessing Human Power for Alternative Energy in Fitness Facilities: A Case Study," In *AASHE Conference on Campus Initiatives to Catalyze a Just and Sustainably World,* Denver, CO, October 10-12, 2010.

Conference Posters

[10] **M. N. Haji**, Johannes Norheim, Olivier L. de Weck "Development of a Platform for Expanding AUV exploRation to Longer ranges (PEARL)," 2019 MIT-Portugal Annual Conference, Ponta Delgada, Azores, September 30, 2019.

[9] **M. N. Haji**, "Extraction of Uranium from Seawater: Design and Testing of a Symbiotic System," 2017 MIT deFlorez Award Competition, Cambridge, MA, May 7, 2017.

[8] **M. N. Haji** and A. H. Slocum, "Extraction of Uranium from Seawater: Design and Testing of a Symbiotic System," 2015 C3E Women in Clean Energy Symposium, Cambridge, MA, November 4-5, 2015.

[7] **M. N. Haji** and A. H. Slocum, "Extraction of Uranium from Seawater: Design and Testing of a Symbiotic System," NAKFI Advanced Nuclear Technologies Mid-Cycle Grant Meeting, Chicago, IL, July 9, 2015.

[6] **M. N. Haji**, T. Peacock, T. M. S. Johnston, and G. S. Carter, "Scattering of the Low-Mode Internal Tide at the Line Islands Ridge," Ocean Sciences Meeting 2014, Honolulu, HI, February 2014.

[5] **M. N. Haji**, S. J. Ghaemsaidi and T. Peacock, "iModes: A Tool for Modal Decomposition of 2-D Internal Wave Fields," École de Physique des Houches Winterschool/Workshop on Waves and Instabilities in Geophysical and Astrophysical Flows, Les Houches, France, February 2013.

[4] **M. N. Haji,** J. Schulmeister, J. Dahl, and M. S. Triantafyllou, "Drag Reduction through Moving Surface Boundary-Layer Control," Society for the Advancement of Chicanos/Hispanics and Native Americans in Science National Conference 2011, San Jose, CA, October 27-30, 2011.

[3] J. Carroll, **M. N. Haji**, M. Schuldman and T. Klos, "University of California, Berkeley Recycling and Waste Receptacles Redesign," AASHE Conference on Campus Initiatives to Catalyze a Just and Sustainable World, Denver, CO, October 10-12, 2010.

[2] **M. N. Haji**, S. Henkel, R. Emmett and A. F. T. Yokochi, "Interaction of Wave Energy Devices and the Environment: Biofouling Concerns on Mooring Systems," Society for the Advancement of Chicanos/Hispanics and Native Americans in Science National Conference 2010, Anaheim, CA, September 30-October 3, 2010.

[1] **M. N. Haji,** K. Lau and A. Agogino, "Human Power Generation in Fitness Facilities," Sigma Xi Annual Meeting and Student Research Conference, The Woodlands, TX, November 12-15, 2009.

HONORS AND AWARDS

Rising Stars in Mechanical Engineering at MIT Participant	2018
National Science Foundation Graduate Research Fellow	2012 – 2017
Earl Ewing Hays Award	2017
Women in Clean Energy, Education, and Empowerment (C3E) Symposium Poster Presenter	2015
MIT Graduate Women of Excellence Award	2015
ASME Innovation Showcase Winner: California Wave Power Technologies	2015
STEM Chateaubriand Fellowship (declined)	2014
Martin A. Abkowitz Award	2013
2009 NOAA Ernest F. Hollings Scholar	2009 – 2011
UC LEADS Scholar	2009 – 2011
Eco-Friendly Stapler, Staples Global EcoEasy Challenge 2nd Place Winner	2010

SELECTED INVITED TALKS, SEMINARS, AND PANELS

[13] "The Science, Policy, Technology, and Economics of Climate Change: Past, Present and Future," Toward a Better Future: Transforming the Climate Crisis, Rothko Chapel Spring Symposium, Houston, TX, March 1, 2019 (panel).

[12] "Expanding ocean utilization through symbiotic offshore systems," University of Michigan, Civil and Environmental Engineering Seminar, Ann Arbor, MI, February 28, 2019.

[11] "Expanding ocean utilization through symbiotic offshore systems," University of Michigan, Naval Architecture and Marine Engineering Seminar, Ann Arbor, MI, February 27, 2019.

[10] "Expanding ocean utilization through symbiotic offshore systems," Caltech, Mechanical and Civil Engineering Seminar, Pasadena, CA February 21, 2019.

[9] "Design of Symbiotic Systems to Extract Critical Minerals from Seawater," Cornell University, Mechanical and Aerospace Engineering Seminar, Ithaca, NY, February 14, 2019.

[8] "Design of Symbiotic Machines to Extract Critical Minerals from Seawater," University of Texas at Austin, Mechanical Engineering Seminar Series, Austin, TX, January 24, 2019.

[7] "Sustainable Sourcing of Critical Minerals from Seawater," Northeastern University, Department of Civil and Environmental Engineering Distinguished Seminar Series, Boston, MA, January 14, 2019.

[6] Finding New Synergies between Water and Energy," Energy and Climate Partnership of Americas, Cambridge, MA, May 8, 2018 (panel).

[5] "Symbiotic Systems for Mineral Extraction from Seawater," National Wind Technology Center, National Renewable Energy Laboratory, Boulder, CO, January 28, 2018.

[4] "Addressing Seawater Mineral Extraction," U.S. Department of Energy Water Power Technologies Office Marine Energy Technologies Forum: Distributed and Alternate Applications, Washington, DC, December 5-7, 2017.

[3] "Robotics, Drones and Sensor Tech Innovation," MIT Startup Exchange Workshop, Cambridge, MA, October 5, 2017 (panel).

[2] "ISHOW Alumni – Success Stories & Raising Capital," American Society of Mechanical Engineers Innovation Showcase 2017, New York City, NY, October 17-19, 2017.

[1] "A journey through sustainability," MIT Trashion Show, Cambridge, MA, December 5, 2014.

TEACHING EXPERIENCE

16.888 Multidisciplinary Design Optimization MIT Spring 2020

Associate Lecturer. Graduate course. Systems modeling for design and optimization. Selection of design variables, objective functions and constraints. Overview of principles, methods and tools in multidisciplinary design optimization (MDO). Students execute a term project in small teams related to their area of interest.

Momentum MIT Jan 2020

Instructor for project-based design course, sponsored by the Office of Minority Education. Delivered lectures on User Interviews. Mentored teams designing solutions to problems faced by unbanked and underbanked populations.

16.887 Technology Roadmapping and Development MIT Fall 2019

Associate Lecturer. Graduate course. Covers the principles, methods and tools of technology management for organizations and technologically-enabled systems including technology forecasting, scouting, roadmapping, strategic planning, R&D project execution, intellectual property management, knowledge management, partnering and acquisition, technology transfer, innovation management, and financial technology valuation.

2.S983 Sports Technology: Engineering and Innovation MIT Fall 2017

Technology Advisor. Mentored team of five students developing passive midsole cooling for Adidas shoes. Advised students as they designed, analyzed, prototyped, and tested various strategies

1.016 Design for Environmental Issues MIT Spring 2015

Mentored team of three freshman students in introductory design and engineering course. Team successfully designed and pool-tested proof-of-concept seawater uranium harvesting machine.

Women's Technology Program in Mechanical Engineering MIT Summer 2015

Instructor. Introduced 20 high school students to engineering as part of intensive four-week program. Carried out program development, which included lectures, demos, and lab experiments.

Engineering Experience MIT Aug 2013, Aug 2014

Fluid Mechanics Project Course Instructor. Developed and taught weeklong undergraduate level fluid mechanics to high school students. Created final project that required students to conduct experiment in the MIT Tow Tank.

STUDENT ADVISING AND MENTORING

Ph.D. Students

- Johannes Norheim (Mentor), PhD Candidate at the Massachusetts Institute of Technology (2018 – present).

Master's Students

- Brenden Horton (Advisor), *Architecting and simulating operations of next-generation AUVs and their servicing platforms*, MIT System Dynamics and Management Program (2019 – present).
- Mollie LeBlanc (co-Advisor), *Digital Twin Technology Roadmap for Enhanced Production in Oil and Gas*, MIT System Dynamics and Management Program (2019 – present).
- Amanda M Hamlet (Mentor), *Uranium extraction from seawater: Investigating the hydrodynamic behavior and performance of porous shells,* Master's thesis, MIT, 2017 – now Staff Engineer at U.S. Coast Guard Marine Safety Center.

Undergraduate Students

- Cedric Delmy, *Design of Integrated Pumped Hydro Reverse Osmosis Systems for Caribbean Nations,* Bachelor's thesis, MIT, Bachelor's thesis, MIT, 2018 – now Product Development Engineer at OMG, Inc.
- Arnav Y. Patel, "Assessing Offshore Oil Rigs for Seawater Mineral Extraction Purposes", Undergraduate Research Opportunity Project, MIT, 2016-2017.
- Cyndia C. Cao, *Exploration of Configurations of Wave Energy Converters to Mechanically Drive a*

Seawater Uranium Harvester, Bachelor's thesis, MIT, 2017 – now graduate student in mechanical engineering at UC Berkeley.

- Bo Paulsen, "Design of Chemical Systems for Use in a Symbiotic Device to Harvest Uranium from Seawater," MIT Summer Research Program, MIT, 2016.
- Jorge Gonzalez, "The effects of protective shell enclosures on uranium adsorbing polymers," Undergraduate Research Opportunity Project, MIT, 2015-2016.
- Cedric Delmy, "Design optimization of a symbiotic system to harvest uranium from seawater," Undergraduate Research Opportunity Project, MIT, 2016.
- Charles Vitry, "Uranium extraction from seawater: Reduction of uranium adsorbent selectivity to vanadium," Undergraduate Research Opportunity Project, MIT, 2014-2015 – now Associate Consultant at Bain & Co.

Professional Associations

IEEE: Institute for Electrical and Electronics Engineers	2020 – present
ASME: American Society of Mechanical Engineers	2010 – present
ANS: American Nuclear Society	2015 – present
ISOPE: International Society of Offshore and Polar Engineers	2016 – present
SNAME: Society of Naval Architects and Mechanical Engineers	2011 – present

Professional Service

Publication Reviewer:

- Industrial & Engineering Chemistry Research
- Energies
- International Ocean and Polar Engineering Conference
- Pacific-Asia Offshore Mechanics Symposium

Grant/Competition Reviewer:

- National Science Foundation Phase I and II SBIR/STTR Program
- Department of Energy Phase I SBIR/STTR Program
- ASME Innovation Showcase, USA Finalists
- Big Ideas Contest

MIT Service:

• MIT Graduate Resident Tutor Feedback Committee	2014 – 2018
• MIT New House Dorm Renovation Committee	2016 – 2017
• MIT Committee on Student Life, Graduate Member	2015 – 2016
• MIT MakerWorkshop, President and Founding Member Featured in MIT Technology Review	2015 – 2017
• MIT New House Dorm, Graduate Resident Tutor	2014 – 2017
• MIT Mechanical Engineering Graduate Association of Women, Co-Chair	2013 – 2017