

Current Position**Assistant Professor**

2014-Present

Mechanical Engineering Department, Tarbiat Modares University, Tehran, Iran

Past Position**NTT Assistant Professor**

2013-2014

Mechanical Engineering Department, Worcester Polytechnic Institute (WPI), Worcester, MA, USA

Postdoctoral Researcher and Research Associate

May 2013-August 2013

Mechanical Engineering Department, Worcester Polytechnic Institute (WPI), Worcester, MA, USA

EDUCATION**Ph.D., Mechanical Engineering**GPA: **4.0/4.0**

May 2013

Worcester Polytechnic Institute, Worcester, MA, USA

Advisor: Stephen S. Nestinger

Thesis: Analytical Workspace, Kinematics, and Foot Force Based

Stability of Hexapod Walking Robots

M.Sc., Mechanical/Manufacturing Engineering

January 2009

Tarbiat Modares University, Tehran, Iran

Advisor: M. J. Nategh

Thesis: Calibration of Hexapod Robot as Machine Tool Table**B.Sc., Mechanical/Manufacturing Engineering**

May 2006

Isfahan University of Technology, Isfahan, Iran

Thesis: Design of Flexible Modular Fixtures**TECHNICAL SKILLS & EXPERTISES**

- **Robotics:** Design, Manufacturing, and Control of different types of robotic platforms
- **Programming:** C/C++, MATLAB, ODE (Open Dynamics Engine/Physics Engine), HTML
- **Measurement:** National Instruments (LabView, DAQ), Sensors and Gauges, 3D measurement using image processing
- **Electronics/Mechatronics:** XBee, Gumstix, Arduino, Wireless communications and Microcontrollers for robot control
- **Fabrication:** 3D printing, CNC, Non-traditional manufacturing processes including Micro/Nano techniques
- **Operating Systems:** Linux (Ubuntu), MS-Windows, Mac OS X
- **Applications:** Mathcad, Maple, CAD/CAM/CAE, MS-Office, Latex

HONORS AND AWARDS

- **Best Student Paper** at the 2013 ASME/IEEE Int. Conf. on Mechatronic and Embedded Systems and Applications.
- **Best Paper in Theory** at the 2012 IEEE/ASME Int. Conf. on Mechatronic and Embedded Systems and Applications.

Book Chapters

1. **Mahdi Agheli**, Stephen S. Nestinger, Foot Force Criterion for Robot Stability, *Adaptive Mobile Robotics*, World Scientific, pp.417-424, 2012.
2. Hamid Rastgar, **Mahdi Agheli**, Maximizing Reachable Workspace of Radially Symmetric Hexapod Walking Manipulator, *Advances in Cooperative Robotics*, World Scientific, pp.567-575, 2016.

JOURNAL PUBLICATIONS

3. **Mahdi Agheli**, Stephen S. Nestinger, Force-Based Stability Margin for Multi-Legged Robots, *Robotics and Autonomous Systems*, 83, pp.138-149, 2016.
4. **Mahdi Agheli**, Stephen S. Nestinger, Foot Force Based Reactive Stability of Multi-Legged Robots to External Perturbations, *Journal of Intelligent and Robotic Systems*, 81 (3), pp.287-300, 2016.
5. Siamak G. Faal, Fuchen Chen, Weijia Tao, **Mahdi Agheli**, Shadi Tasdighikhalat, and Cagdas D. Onal. Hierarchical Kinematic Design of Foldable Hexapedal Locomotion Platforms, *Journal of Mechanisms and Robotics*, 8 (1), pp. 011005, 2016.
6. Ming Luo, **Mahdi Agheli**, and Cagdas D. Onal, Theoretical Modeling and Experimental Analysis of a Pressure-Operated Soft Robotic Snake, *Soft Robotics*, 1 (2), pp.136-146, 2014.
7. **Mahdi Agheli**, Long Qu, and Stephen S. Nestinger, SHeRo: Scalable Hexapod Robot for Maintenance, Repair, and Operations, *Robotics and Computer-Integrated Manufacturing*, 30 (5), pp.478-488, 2014.
8. **Mahdi Agheli**, Stephen S. Nestinger, Closed-Form Solution for Constant-Orientation Workspace and Workspace-Based Design of Radially Symmetric Hexapod Robots, *ASME Journal of Mechanisms and Robotics*, 6 (3), pp.031007-031007-13, 2014.
9. **Mahdi Agheli**, Stephen S. Nestinger, Comprehensive Closed-Form Solution for the Reachable Workspace of 2-RPR Planar Parallel Mechanisms, *Mechanism and Machine Theory*, 74, pp.102-116, 2014.
10. **M.M. Agheli**, M.J. Nategh, Identifying the Kinematic Parameters of Hexapod Machine Tool, *International Journal of Aerospace and Mechanical Engineering*, 4 (3), pp.149-154, 2010.
11. M.J. Nategh, **M.M. Agheli**, A Total Solution to Kinematic Calibration of Hexapod Machine Tools With A Minimum Number of Measurement Configurations and Superior Accuracies, *International Journal of Machine Tools and Manufacture*, 49 (15), pp.1155-1164, 2009.
12. Yousef Hojjat, **M. Mahdi Agheli**, A Comprehensive Study on Capabilities and Limitations of Roller-Screw with Emphasis on Slip Tendency, *Mechanism and Machine Theory*, 44 (10), pp.1887-1899, 2009.
13. Hamid Rastgar, **Mahdi Agheli**, Design of hexapod walking robots based on workspace maximization, *Modares Mechanical Engineering*, 16 (9), pp.216-222, 2016.

PEER-REVIEWED CONFERENCE PAPERS

14. H. Shahmohammadi Dermeni, M. J. Nategh, **M. M. Agheli**, Upgrading the CNC system of hexapod machine tool by adding the five axis drilling cycle, *Modares Mechanical Engineering, Proceedings of the Advanced Machining and Machine Tools Conference*, Vol. 15, No. 13, pp. 485-489, 2015. (in Persian)
15. S.V. Hosseini, M. J. Nategh, **M.M. Agheli**, H. Imani, Optimum design of rotary forging machine with parallel mechanism, *Modares Mechanical Engineering, Proceedings of the Advanced Machining and Machine Tools Conference*, Vol. 15, No. 13, pp. 486-490, 2015. (in Persian)
16. **M.M. Agheli**, Stability Analysis of a Hexapod Walking Manipulator over Uneven Terrain, *Modares Mechanical Engineering, Proceedings of the Advanced Machining and Machine Tools Conference*, Vol. 15, No. 13, pp. 481-484, 2015. (in Persian)
17. Ming Luo, **Mahdi Agheli**, Cagdas D. Onal, Theoretical Modeling of a Pressure-Operated Soft Snake Robot, *ASME International Design & Engineering Technical Conferences and Computers & Information in Engineering Conference IDETC/CIE*, Buffalo, New York, USA, August 17-20, 2014.
18. **Mahdi Agheli**, Siamak G. Faal, Fuchen Chen, Huibin Gong, Cagdas D. Onal, Design and Fabrication of a Foldable Hexapod Robot Towards Experimental Swarm Applications, *IEEE International Conference on Robotics and Automation*, Hong Kong, China, May 31 - June 7, 2014.

19. Long Qu, **Mahdi Agheli**, Stephen S. Nestinger, Lateral Stable Workspace of Hexapod Walking Machines with Constant Orientation of Platform, ASME/IEEE International Conference on Mechatronic and Embedded Systems and Applications (MESA), IDETC/CIE Conferences, Portland, Oregon, USA, August 4-7, 2013.
20. **Mahdi Agheli**, Stephen S. Nestinger, Robert L. Norton, Analytical Study of Reachable Workspace for 2-RPR Planar Parallel Mechanisms, in Proceedings of the ASME Mechanisms and Robotics, IDETC/CIE Conferences, Chicago, Illinois, USA, August 12-15, 2012.
21. **Mahdi Agheli**, Stephen S. Nestinger, Foot Force Criterion for Robot Stability, in proceedings of the 15th International Conference on Climbing and Walking Robots and the Support Technologies for Mobile Machines, Johns Hopkins University, Maryland, USA, July 23-26, 2012 .
22. **Mahdi Agheli**, Stephen S. Nestinger, Closed-Form Solution for Reachable Workspace of Axially Symmetric Hexapod Robots, in Proceedings of the 8th IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications, Suzhou, China, July 8-10, 2012.
23. **Mahdi Agheli**, Stephen S. Nestinger, Study of the Foot Force Stability Margin for Multi-Legged/Wheeled Robots Under Dynamic Situations, in Proceedings of the 8th IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications, Suzhou, China, July 8-10, 2012.
24. **Mahdi Agheli**, Stephen S. Nestinger, Lateral Reachable Workspace of Axially Symmetric Mobile Machining Hexapod Robots, in Proceedings of the 8th IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications, Suzhou, China, July 8-10, 2012.
25. **Mahdi Agheli**, Stephen S. Nestinger, Inverse Kinematics for Arbitrary Orientation of Hexapod Walking Robots with 3-DOF Leg Motion, The 15th IASTED International Conference on Robotics and Applications, Cambridge, Massachusetts, USA, November 1-3, 2010.
26. **M.M. Agheli**, M.J. Nategh, Observability of Kinematics Parameter Errors for Calibration of Parallel Robots as Stewart Platform, The 9th ICME Conference on Manufacturing Engineering, University of Birjand, Iran, March 3-5, 2009.
27. **M.M. Agheli**, M.J. Nategh, Determination of Optimal Location for Joint Centers in Hexapod Machine Tool Configuration, The 17th ISME Annual (International) Conference on Mechanical Engineering, University of Tehran, Iran, May 19-21, 2009. (in Persian)
28. **M.M. Agheli**, M.J. Nategh, Calibration of Hexapod Machine Tool, The 17th ISME Annual (International) Conference on Mechanical Engineering, University of Tehran, Iran, May 19-21, 2009. (in Persian)
29. **M.M. Agheli**, M.J. Nategh, 6-DOF Measurement of Position and Orientation of Hexapod Machine Tool by Using A Digital Camera, The 17th ISME Annual (International) Conference on Mechanical Engineering, University of Tehran, Iran, May 19-21, 2009. (in Persian)
30. **M.M. Agheli**, M.J. Nategh, Measurement of Kinematics Parameters of Hexapod Machine Tool and Experiment Design by Taguchi Method, The 16th ISME annual (International) Conference on Mechanical Engineering, Shahid Bahonar University of Kerman, Iran, May 13-15, 2008. (in Persian)

PRESENTATIONS

- Mahdi Agheli, Long Qu, Stephen S. Nestinger, Scalable six-legged ambulating robot with foot force-based reactive stability, *Dynamic Walking*, Carnegie Mellon University, USA June 2013
- Mahdi Agheli, Stephen S. Nestinger, Bio-inspired Reactive Stability of Legged Robots Graduate Research Achievement, Worcester Polytechnic Institute, USA March 2013
- Mahdi Agheli, Stephen S. Nestinger, Multi-Robot field Repair and Maintenance in inaccessible and Hazardous Environments, Northeast Robotics Colloquium, Stata Center, CSAIL, MIT, USA October 2012
- Mahdi Agheli, Stephen S. Nestinger, Multi-Robot field Repair and Maintenance in inaccessible and

Hazardous Environments, Graduate Research Achievement, Worcester Polytechnic Institute, USA	March 2012
<ul style="list-style-type: none"> • Mahdi Agheli, Stephen S. Nestinger, Reachable workspace of Scalable Hexapod Walking Robot with Extendable Legs, Graduate Research Achievement, Worcester Polytechnic Institute, USA 	March 2011
<ul style="list-style-type: none"> • Mahdi Agheli, Stephen S. Nestinger, Kinematic solution for arbitrary orientation of axially symmetric hexapod walking robots, Graduate Research Achievement, Worcester Polytechnic Institute, USA 	March 2010

RESEARCH EXPERIENCE

NTT Assistant Professor: Robotics and Mechanics 2013-2014

- Conducted a new research project to develop an intelligent shoe pad for gait monitoring in older adults to help them improve their walking ability.
- Supervised multiple senior students for their Major Qualifying Project to build the intelligent shoe pad for gait monitoring in older adults.
- Submitted proposal to National Science Foundation (NSF) for research grant regarding the intelligent shoe pad for gait monitoring in older adults and ready to submit one to NIH.
- Collaborated with SoftRobotics Lab to design, fabricate, and control folded legged robots, soft robots (such as snake robot), soft arms, and soft manipulators.

Postdoctoral Research: Mechatronics and Soft Robotics 5/2013-

- Oversaw multiple Ph.D., Master, and undergraduate students in the field of mechatronics and soft robotics. 8/2013
- Fabricated a scalable hexapod walking robot for monitoring and repair in inaccessible and hazardous environments.
- Developed a tiny hexapod running robot for swarm applications in rough environments.
- Collaborated in developing a soft snake robot for exploring inaccessible environments.

Ph.D. Thesis: Analytical Workspace, Kinematics, and Foot Force-Based Stability of Hexapod Walking Robots 2010-2013

- Developed a scalable hexapod walking robot from scratch with ability to change its size to be compatible for walking and manipulation in a wide range of unknown environments with uneven surface. To be employed for different applications such as search and rescue, in-situ machining, maintenance, repair, inspection, etc. to remove human working in difficult to access and hazardous environments such as remaining debris after earthquake and fire, ship hulls, bridge installations, oil rigs, etc.
- Analyzed Kinematics, Locomotion, Workspace, Dynamics, and Stability of multi-legged robots comprehensively.
- Derived analytical solutions for the lateral and spatial reachable workspace of hexapod walking robots which aid in the design and optimization of the robot parameters and workspace.
- Developed a novel force-based stability margin for control of multi-legged/wheeled robots usable for robot reaction under static/quasi-static external stimuli over uneven terrain.
- Derived a modified version of stability margin to account for the geometrical and physical

attributes of the robot.

- Developed a control scheme to integrate the analytical workspace and the novel stability margin which resulted in a Bio-Inspired Reactive Control strategy for hexapod walking robots.
- Oversaw and directed multiple Master students in design and prototype of the scalable robot.
- Developed proposal for National Science Foundation (NSF).

M.Sc. Thesis: Calibration of Hexapod Machine Tool

2006-2009

- Obtained minimum possible set of measurement configurations of the hexapod robot to be used for calibration process with high accuracy. Measured 3D position and orientation of the hexapod moving platform using a single digital camera. Calibrated the hexapod machine tool with accuracy of $\pm 0.1\text{mm}$ and $\pm 0.03^\circ$ for positioning and orienting the moving platform respectively.

Bachelor Thesis: Flexible Modular Fixtures

2005-2006

- Performed research on flexible modular fixture and proposed new design.

Selected Graduate Course Projects

- **Robot Dynamics:** Analyzed kinematics, dynamics, and control of hexapod walking robots. Spring 2010
- **Design & Analysis of MFG Processes:** Designed a Nylon Strap Spiral Wrapping Tool using Axiomatic design principles. Fall 2009
- **Control & Monitoring of MFG Processes:** Designed a Controller for Unmanned Vehicles. Fall 2009
- **Precise Instruments:** Built a Linear Variable Differential Transformer (LVDT). Fall 2006
Researched on Ball Screw ending up with a journal publication.

TEACHING EXPERIENCE

NTT Assistant Professor: Worcester Polytechnic Institute, Worcester, MA

2013–present

Currently teaching three courses:

- Introduction to Static Systems
- Introduction to Dynamic Systems
- Introduction to Computer Aided Design

Lecturer: Shahid Sadoughi Yazd Technical College, Yazd, Iran

2007–2009

Lectured and developed lecture materials including assignments, homework, and exams for the following semester-based courses: (~40 students per class)

- Design and Manufacturing
- Cutting, Bending, and Deep drawing dies
- Advanced Measurement Systems
- Machine Elements Design
- CAD/CAM/CAE
- Process of Design

Teaching Assistant: Worcester Polytechnic Institute, Worcester, MA

ME-3310: **Kinematics of Mechanisms** (~75 students)

Spring 2013

- Held lab sessions.
- Held a teaching session in class upon request of the professor.

ME/RBE-4322: **Modeling and Analysis of Mechatronic Systems** (~30 students)

Fall 2012 & Spring 2013

ME-3320:	Design of Machine Elements	(~30 students)	Fall 2012
	<ul style="list-style-type: none"> • Taught the course when the instructor was away. • Held help sessions. 		
ES-1310:	Introduction to Computer Aided Design	(~70 students)	Spring 2012
	<ul style="list-style-type: none"> • Assisted with material preparation for the class. • Led lab sessions for student questions and problems. 		
ME-2300:	Introduction to Engineering Design	(~40 students)	Spring 2012
	<ul style="list-style-type: none"> • Assisted with preparation of quiz problems. • Judged student final presentations and experimental work. 		

PATENTS

1. **M.M. Agheli**, *3-D Optical Measurement System*, Iran Industrial Ownership Office, September 2008
Declaration No: 387061383, Patent No: 52990.
2. **M.M. Agheli**, *Rotary Fixture*, Iran Industrial Ownership Office, Declaration No: 38611575, April 2008
Patent No: 47189.
3. **M.M. Agheli**, *Oil Sprayer*, Iran Industrial Ownership Office, Declaration No: 38704116, July 2008
Patent No: 50271.
4. **M.M. Agheli**, *A New System of CNC Table Movement*, Iran Industrial Ownership Office, July 2008
Declaration No: 38704117, Patent No: 50272.

INDUSTRIAL EXPERIENCE

Supervisor, Technical Department, R&D Division

Summer 2006

Ghadir Loom Machine Manufacturing Factory, Yazd, Iran

- Managed development and successful production release of a turning machine tool.
- Oversaw installation of machine tools in consumer locations.
- Researched machine tooling options and presented best choices based on functionality, quality, and cost.

REVIEWER

- IEEE Transactions on Robotics
- Mechanism and Machine Theory
- Journal of Biomechanics
- Journal of Applied Mathematical Modelling
- Journal of Intelligent Service Robotics
- Journal of Intelligent & Robotic Systems
- Scientific Journal of Mechanic Engineering
- Journal of Mechanics Engineering and Automation
- International Journal of Advanced Robotic Systems
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- IEEE International Conference on Technologies for Practical Robot Applications (TePRA)
- ASME/IEEE International Conference on Mechatronic and Embedded Systems and Applications (MESA)

- ASME Int. Design Engineering Technical Conf. & Computers and Information in Engineering Conf. (IDETC/CIE)

OUTREACH

- Served as reviewer for a proposal in National Science Foundation (NSF). 2014
- Served as Judge for the Major Qualifying Project (MQP) Competition (Senior Undergraduate Students)
at Worcester Polytechnic Institute, Mechanical Engineering Department. April 2012

PROFESSIONAL MEMBERSHIPS

- Institute of Electrical and Electronics Engineers (IEEE), Robotics and Automation Society, Member 2009-present
- American Society of Mechanical Engineering (ASME), Dynamic Systems & Control, Member 2009-present
- Climbing and Walking Robots (CLAWAR) Association, Member 2012

LANGUAGES

- English, Farsi