MOSTAFA BAGHERI, Ph.D. in Mechanical and Aerospace Engineering - Robotics

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SUMMARY

Robotics & Control Systems Engineer with a primarily focus on dynamic analysis, optimization, and control of nonlinear systems, in particular robotic systems, and a proven track record of creating robust technology solutions to technical challenges. Recognized as an authority in the research and academic community.

COMPUTER SKILLS

- **Programming Skills:** *Proficient*: Python, C++, Java, MATLAB, Simulink; *Intermediate*: ReactJS
- **Packages:** pybind11, Keras, OpenCV, NumPy, Matplotlib, scikit-learn
- **Design Tools:** SolidWorks, Fusion 360, ADAMS, Autodesk Inventor
- **Misc.:** ROS, Gazebo, RViz, Git/GitHub, Docker

RESEARCH INTEREST

- Dynamic Systems & Control
- Nonlinear Dynamics & Control
- Robotics & Mechatronics
- Adaptive Control
- Time-Delay Systems
- System Identification
- Machine Learning
- Motion Planning
- Game Theory

PROFESSIONAL EXPERIENCES

- **Johnson & Johnson**, Santa Clara, CA, USA
  Senior Robotics and Controls Engineer *July 2022 – present*

- **Vicarious**, Union City, CA, USA
  Roboticist - Member of Motion & Control Team *March 2021 – May 2022*
  MAIN TASKS: Develop, debug, and maintain our control and motion planning codes by analyzing logs | Improve our simulation tools feature to give more info to the user | Fix sporadic failures of motion/control tests running on the Ignition Environment | Converting python packages to C++.

- **NXT Robotics** Corp., San Diego, CA, USA
  Chief Technology Officer (CTO) *July 2019 – March 2021*
  - COMPANY GOAL: "*Develop Fully Autonomous and Intelligent Robots for Security Applications.*"
  - MAIN DUTIES: Support roadmap planning and build an engineering team | Develop mechanical, electrical, and software systems for Rovers | Develop a sophisticated autonomous navigation algorithm | Integrate Edge AI with automated alerting for object detection, face recognition, license plate recognition, and pose estimation.

- **Glidewell Dental Lab**, Irvine, CA, USA
  Robotics Consultant - Research and Development Department *August 2019 – November 2019*
  - PROJECT TITLE: "*Automation of Dental Crown Finishing Process*"
  - MAIN TASKS: Train Glidewell's staff to use ROS and its various tools including visual and physics simulators | Develop packages and custom robot description in ROS with various grippers for visualization and physical simulation | Develop a simulation and actual testbed for evaluating generic grasping applications.

- **University of California, San Diego**, La Jolla, CA, USA
  - **Instructor** - Fundamentals of Engineering Applications (ENG 10) *Summer 2019*
    COURSE DESCRIPTION: This course is an application-oriented and hands-on introduction to engineering mathematics and design processes. Key mathematical concepts are taught including least-squares regression, gradient & partial derivatives, probability & statistics, and an introduction to Fourier transform (TF).
  - **Mentor** - Alexander Bertino, Ph.D. Student, Dept. of Mechanical Eng. *September 2019 - May 2021*
  - **Graduate Research Assistant** - Nonlinear and Adaptive Control Lab. *September 2015 - May 2019*
  - **Teaching Assistant** - Nonlinear System (MAE 281A) *Winter 2016*

- **San Diego State University**, San Diego, CA, USA
  - **Instructor** - Control Systems Laboratory (ME 330) *Summer 2017*
    COURSE DESCRIPTION: The course introduces important concepts in the analysis and design of control systems including mathematical modeling of mechanical & electrical systems, introduction to feedback control, transient & steady-state response analysis, and stability analysis using root-locus & frequency response methods.
  - **Mentor** - Nathan Thomas, M.Sc. Student, Dept. of Mechanical Eng. *Sept. 2018 - Sept. 2019*
  - **Graduate Research Assistant** - Dynamic Systems and Control Lab. *Sept. 2015 - May 2019*
  - **Teaching Assistant** - Robot Modeling & Control (ME 596) | Dynamics (ME 220) | Computer Programming Application (ME 202)

- **Italian Institute of Technology (IIT)**, Genova, Italy
  Graduate Researcher - Advanced Robotics Department, *April 2014 – December 2014*
  - ◇ PROJECT TITLE: "*Design of Mechanical Systems and Controllers for Humanoid WALK-MAN*"
  - ◇ MAIN TASK: Quantify the effect of shoulders base frame orientation in a dual-arm manipulation robot by looking at several important manipulation indices, and design the arm for having the best manipulation performance.

EDUCATION

- **University of California, San Diego** *September 2015 - May 2019*
  - ◇ Ph.D. in Mechanical & Aerospace Eng. – Robotics **GPA: 4.0/4.0**
    DISSERTATION TITLE: Adaptive and Delay-Compensating Robot Controllers
    Supervisors: Profs. Miroslav Krstić and Peiman Naseradinmousavi
    Some Related Courses: Linear Control Design, Nonlinear Controls, Robust & Multi-Variable Control, Optimal Estimation, Learning Algorithms (Machine Learning)
  - ◇ Technology Management and Entrepreneurism Program *April 2016 - April 2017*
    Institute for the Global Entrepreneur, Rady School of Management

- **Amirkabir University of Technology (Tehran Polytechnic)** *September 2006 - February 2013*
  - ◇ M.Sc. in Mechanical Engineering (September 2010 - February 2013) **GPA: 3.9/4.0**
  - ◇ B.Sc. in Mechanical Engineering (September 2006 - September 2010) **GPA: 3.95/4.0**
    Awarded Best B.Sc. thesis *by ISME in 2010*
  - ◇ B.Sc. in Chemical Engineering (*Second Major*)

HONORS AND AWARDS

- Awarded **Four-year Scholarship** for the Ph.D. program *September 2015 - May 2019*
- Awarded **Elsevier Outstanding Reviewer** status, The Journal of the Franklin Institute *August 2018*
- Awarded **Graduate Fellowship**, *Iran's National Elites Foundation (INEF)* *March 2013 - May 2015*
- Awarded **Annual Award** for the **Best B.Sc. Thesis** in Mechanical Eng. by ISME *December 2010*
- **Ranked in the top 5** among B.Sc. Mechanical Eng. Students, class of 2010 *Sept. 2006 - Dec. 2010*
- **Dual Degree Student** (Mechanical and Chemical Engineering) *Sept. 2008 - Dec. 2012*
- **Ranked in the top 3** among M.Sc. Mechanical Eng. Students, class of 2012 *Sept. 2010 - Dec. 2012*
- Awarded **University Fellowship** as an **Exceptionally Talented Student** *2006 - 2012*
  Amirkabir University of Technology (Tehran Polytechnic)
- **Ranked** 5^{th} in Iran National University Students' Olympiad in Mechanical Engineering *2009*
  Ministry of Science, Research and Technology, Tehran, Iran
- Awarded **Direct Admission to M.Sc. program** (without nationwide M.SC. entrance exam) *2010*
- **Ranked among the top 0.05%** in Iran's National University Entrance Exam (over 400,000 participants)

RESEARCH PROJECTS

- Natural Language Processing: Analysis of Various Comedians' Transcripts using Python *Summer 2020*
- Adaptive Certainty-Equivalence Control with Finite-Time Least-Squares Identification *2019*

- Autonomous Deep Learning-Based Grasping and Obst. Avoid. Path Planning *Oct. 2018 - Mar. 2019*
  - ◇ Designed and implemented different controllers and machine learning algorithms on the Baxter manipulator. Some videos can be found at: http://flyingv.ucsd.edu/mostafa/research.html
- Deep Learning for Speech Recognition: Trigger Word Detection *Fall 2019*
- Developing Different Classifiers and CNN for MNIST Handwritten Digit Dataset *Winter 2018*
- Design and Implement Nonzero-Sum Game-Based Control of Baxter Manipulator *Sept. 2018 - May 2019*

- Design Motion/Path Planning Using ROS and implementation on UR5 *Aug. 2019 - Nov. 2019*
  - ◇ In the Research and Development department of Glidwell Dental Laboratory, I worked on path planning (using MoveIt), simulation (using Gazebo), and implementation (on UR5) of the collision-free pick-and-place operation of the dental crown.
- Predictor-Based Control of Baxter Manipulator with Input Delay *October 2017 - May 2018*

- Design and Implement Model-Based Adaptive Control for Baxter Manipulator *2017*
- Baxter Manipulator's Trajectory Optimization Using Discrete-Time Extremum Seeking *2016*
- Networked-Based Optimization and Control of Smart Actuated Valves *May 2015 - January 2016*
- Output-Feedback Control Design for a MIMO Model of a 2-DOF Helicopter *Spring 2016*
- Classical, LQR, LQG, and H_∞ Control Design for a SISO Linear System *Winter 2015*

- Design of Mechanical Systems and Controllers for Humanoid WALK-MAN *April 2014 - December 2014*
  - ◇ In the manipulation group, I worked on designing the tilted shoulders' angles to optimize performance indices for WALK-MAN (the European project FP7-ICT-611832-2013). Videos of can be found at: https://www.youtube.com/watch?v=kZzwVwzAWME
- Modeling, Design, and Optimization of the Suspension System of a Ten-Wheeled Truck *2013*
- Optimal Control Design for Rotary Flexible Link with Experimental Evaluation *Summer 2012*
- Trajectory Optimization with Path Constraints for an Airplane *Spring 2011*
- Control of Canned Filling and Packing Line with PLC *2009*
- Apply Different Classification Methods Including Multivariate Gaussian and Bayesian *Winter 2015*
- Modeling and Control Double Inverted Pendulum *2012*

TALK AND PRESENTATION

INVITED TALK:

- Talk at Kia Cooperative Systems Lab (KCS-lab), University of California Irvine, CA *May 2019*
- Talk at South Bay Tech Summit, Hilltop High School, San Diego *May 2019*
- Talk at San Diego State University, SIAM-SDSU Summer Colloquium *July 2018*

PRESENTATION:

- Talk at Dynamic System and Control Conference (DSCC), Park City, Utah *October 2019*
- Talk at Dynamic System and Control Conference (DSCC), Atlanta, GA *September 2018*
- Talk at American Control Conference (ACC), Milwaukee, WI *June 2018*
- Talk at Dynamic System and Control Conference (DSCC), Tysons Corner, VA *October 2017*
- Talk at Dynamic System and Control Conference (DSCC), Minneapolis, MN *October 2016*
- Talk at the Dept. of Advanced Robotics, Italian Institute of Technology (IIT), Genova, Italy *May 2014*
- Talk at the Department of Mechanical Eng., Amirkabir University of Technology *December 2013*
- Talk at IAA Conf. on Dyn. and Control of Space Systems (DyCoSS), Porto, Portugal *Mar. 2012*

PROFESSIONAL SERVICES

- **Reviewer for more than 10 Journals** including Automatica, IEEE Control Systems Letters (L-CSS), Journal of Franklin Institute (*Outstanding Reviewer*)
- **Reviewer for more than 10 Conferences** including IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), IEEE International Conference on Robotics and Automation (ICRA), The American Control Conference (ACC), IEEE Conference on Decision and Control (CDC)
- **Co-authored a Proposal** for National Science Foundation (NSF) *September 2018 - August 2019*
  Research Proposal Title: Decentralized Adaptive and Extremum Seeking Control of Robot Manipulators Using Image Processing (Award Number: 1823983)

PUBLICATIONS

CITATIONS: 270
H-INDEX: 11
I10-INDEX: 15
(GOOGLE SCHOLAR)

JOURNAL ARTICLES:

(J10) **M. Bagheri**, I. Karafyllis, P. Naseradinmousavi, and M. Krstić, "Adaptive Control of a Two-Link Robot Using Batch Least-Square Identifier," *IEEE/CAA J. of Automatica Sinica*, Vol. 7, pp. 1–8, Aug. 2020

(J9) **M. Bagheri**, M. Krstić, and P. Naseradinmousavi, "Feedback Linearization Based Predictor for Time Delay Control of a High-DOF Robot Manipulator," *Automatica*, 108, pp. 108485, 2019.

(J8) **M. Bagheri**, M. Krstić, and P. Naseradinmousavi, "Multivariable Extremum Seeking for Joint-Space Trajectory Optimization of a High-Degrees-of-Freedom Robot," *ASME Journal of Dynamic Systems, Measurement and Control*, Vol. 140, Issue 11, pp. 111017-1 – 111017-13, 2018.

(J7) **M. Bagheri** and P. Naseradinmousavi, "Novel Analytical and Experimental Trajectory Optimization of a 7-DOF Baxter Robot: Global Design Sensitivity and Step Size Analyses," *International Journal of Advanced Manufacturing Technology*, Springer, Vol. 93, Issue 9-12, pp 4153–4167, Dec. 2017.

(J6) P. Naseradinmousavi, H. Ashrafiuon, and **M. Bagheri**, "A Decentralized Neuro-Adaptive Control Scheme to Suppress Chaotic/Hyperchaotic Dynamics of Smart Valves Network," *ASME Journal of Computational and Nonlinear Dynamics*, Vol. 13, Issue 5, pp. 051008, Apr. 2018.

(J5) I. Kardan, M. Kabganian, R. Abiri, and **M. Bagheri**, "Stick-Slip Conditions in the General Motion of a Planar Rigid Body," *J. of Mechanical Science and Technology*, Springer, Vol. 27, Issue 9, pp. 2577-2583, 2013.

(J4) **M. Bagheri**, M. Kabganian, and R. Nadafi, "Three-axis Attitude Control Design for a Spacecraft Based on Lyapunov Stability Criteria," *Scientia Iranica, Transaction B: Mechanical Engineering*, Vol. 20, Issue 4, pp. 1302–1309, 2013.

(J3) **M. Bagheri** and P. Mottaghizadeh, "Analysis of Tool-Chip Interface Temperature with FEM and Empirical Verification," *International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering*, Vol. 6, No. 8, pp. 1766–1775, 2012.

(J2) P. Mottaghizadeh and **M. Bagheri**, "3D Modeling of Temperature by Finite Element in Machining With Experimental Authorization," *International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering*, Vol. 6, No. 8, pp. 1646–1652, 2012.

(J1) A. Fata, **M. Bagheri**, and P. Mottaghizadeh, "Tool Temperature Prediction during Machining by FEM with Experimental Validation," *J. of Basic and Applied Sci. Research*, Vol. 2, Issue 12, pp. 12606–12610, 2012.

CONFERENCE PROCEEDINGS:

(C13) **M. Bagheri** and A. Bertino, P. Naseradinmousavi, "Experimental and Analytical Nonzero-Sum Differential Game-Based Control of a 7-DOF Baxter," *ASME Dynamic Systems and Control Conf. (DSCC 2020)*, Paper No. DSCC2020-23518, Oct. 4-7, Pittsburgh, PA, USA, 2020.

(C12) **M. Bagheri**, M. Krstić, and P. Naseradinmousavi, "Time Delay Control of a High-DOF Robot Manipulator Through Feedback Linearization Based Predictor," *ASME Dynamic Systems and Control Conf. (DSCC 2019)*, Paper No: DSCC2019-8915, Oct. 8-11 , Park City, Utah, USA, 2019.

(C11) A. Bertino, **M. Bagheri**, M. Krstić, and P. Naseradinmousavi, "Experimental Autonomous Deep Learning-Based 3D Path Planning for a 7-DOF Robot Manipulator," *ASME Dynamic Systems and Control Conf. (DSCC 2019)*, Paper No: DSCC2019-8951, Oct. 8-11 , Park City, Utah, USA, 2019.

(C10) **M. Bagheri**, M. Krstić, and P. Naseradinmousavi "Analytical and Experimental Predictor-Based Time Delay Control of Baxter Robot," *ASME Dynamic Systems and Control Conf. (DSCC 2018)*, Paper No. DSCC2018-9101, Sept. 30 - Oct. 3, Atlanta, GA, USA, 2018.
Highlighted Research in the ASME DSCD newsletter *Winter 2018*

(C9) **M. Bagheri**, M. Krstić, and P. Naseradinmousavi, "Joint-Space Trajectory Optimization of a 7-DOF Baxter Using Multivariable Extremum Seeking," *IEEE American Control Conf. (ACC 2018)*, pp. 2176–2181, June 27-29, Milwaukee, WI, USA, 2018.

(C8) P. Naseradinmousavi, H. Ashrafiuon, and **M. Bagheri**, "Suppressing Chaotic and Hyperchaotic Dynamics of Smart Valves Network Using A Centralized Adaptive Approach," *IEEE American Control Conf. (ACC 2018)*, pp. 1671–1676, June 27-29, Milwaukee, USA, 2018.

(C7) **M. Bagheri**, P. Naseradinmousavi, and R. Morsi, "Novel Analytical and Experimental Trajectory Optimization of a 7-DOF Baxter Robot: Global Design Sensitivity and Step Size Analyses," *ASME Dynamic Systems and Control Conf. (DSCC 2017)*, Vol. 1, pp. V001T30A001, Paper No. DSCC2017-5004, Oct. 11-13, Tysons Corner, VA, USA, 2017.

(C6) **M. Bagheri**, P. Naseradinmousavi, M. Ashrafiuon, H.Canova, and D. B. Segala "Suppressing Chaotic and Hyperchaotic Dynamics of Smart Valves Network Using Decentralized and Centralized Schemes," *ASME Dynamic Systems and Control Conf. (DSCC 2017)*, Vol. 3, pp. V003T42A001, Paper No. DSCC2017-5006, Oct. 11-13, Tysons Corner, VA, USA, 2017.

(C5) P. Naseradinmousavi, **M. Bagheri**, M. Krstić, and C.Nataraj, "Coupled Chaotic and Hyperchaotic Dynamics of Actuated Butterfly Valves Operating in Series," *ASME Dynamic Systems and Control Conf. (DSCC 2016)*, Vol. 2, pp. V002T17A001, Paper No. DSCC2016-9601, Oct. 12-14, Minneapolis, MN, USA, 2016.

(C4) P. Naseradinmousavi, **M. Bagheri**, and C.Nataraj, "Coupled Operational Optimization of Smart Valve System Subject to Different Approach Angles of A Pipe Contraction," *ASME Dyn. Systems and Control Conf. (DSCC 2016)*, Vol. 1, pp. V001T02A001, Paper No. DSCC2016-9627, Oct. 12-14, Minneapolis, MN, USA, 2016.

(C3) **M. Bagheri**, A. Ajoudani, J. Lee, D. Caldwell, and N. Tsagarakis, "Kinematic Analysis and Design Considerations for Optimal Base Frame Arrangement of Humanoid Shoulders," *IEEE International Conf. on Robotics and Automation (ICRA 2015)*, pp. 2710–2715, May 26-30, Seattle, WA, USA, 2015.

(C2) **M. Bagheri**, M. Kabganian, and R. Nadafi, "Stable Design of Attitude Control for A Spacecraft," *IAA Conf. on Dynamics and Control of Space System (DyCoSS 2012)*, Advances in the Astronautical Sciences, Vol. 145, pp. 777–788, Mar. 19-21, Porto, Portugal, 2012

(C1) M. Kabganian, R. Nadafi, Y. Tamhidi, and **M. Bagheri**, "A Novel Mechanical Attitude Simulator with Adaptive Control for Micro-Satellite," *IEEE International Conf. on Control, Instrumentation, and Automation (ICCIA 2011)*, pp. 694–698, Dec. 27-29, Shiraz, Iran, 2011