S M NAHID MAHMUD

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Education

Oklahoma State University (OSU) **Jan. 2019 - May 2021**
Masters of Science in Mechanical and Aerospace Engineering, 3.87/4.00 *Stillwater, Oklahoma*

Islamic University of Technology (IUT) **Jan. 2012 - Dec. 2015**
Bachelor of Science in Mechanical Engineering, 3.74/4.00 *Dhaka, Bangladesh*

Experience

Research Engineer **Aug. 2021 - Current**
Systems, Cognition, and Control Laboratory, OSU *Stillwater, Oklahoma*

- Working on the Development of a local model learning method for deterministic continuous-time nonlinear systems.

Graduate Research Assistant **May 2019 - May 2021**
Systems, Cognition, and Control Laboratory, OSU *Stillwater, Oklahoma*

- Developed two novel Model-Based Reinforcement Learning frameworks for safety-critical nonlinear systems with parametric uncertainties and partial output feedback.

Graduate Teaching Assistant **Jan. 2019 - Aug. 2020**
Mechanical and Aerospace Engineering Department, OSU *Stillwater, Oklahoma*

- Supported 150+ students to have a better understanding of dynamics and coached four students for a senior design project on autonomous robot for underground excavation.

Adjunct Lecturer **Sep. 2017 - Dec. 2018**
Mechanical Engineering Department, Sonargaon University *Dhaka, Bangladesh*

- Taught 300+ students dynamics and automatic control concepts and administered dynamical modeling simulations.

Technical Skills

Programming Languages	C, C++, Python, Arduino IDE, Ardupilot.
Web Language	HTML, CSS, JavaScript.
Design Software	Solid Works, Adobe Photoshop, Adobe Illustrator, 3D max.
Simulation software	Ansys, Matlab, Simulink, Comsol, Netlogo, Webot.
Hardware	Pixhawk, Arduino, Sonar, LCD, GPRS, Bluetooth, Wi-Fi.

Relevant Projects

Safety Aware Navigation | *MATLAB, GPOPS II* **Oct. 2019 - April 2021**

- Developed two novel Model-Based Reinforcement Learning frameworks with parametric uncertainties and partially observable nonlinear systems.
- The frameworks incorporate barrier transformation to guarantee 100 % safe navigation for nonlinear systems.

Minimum Time-to-Climb of a Supersonic Aircraft | *Optimization, MATLAB, GPOPS II* **Sep. 2020 - Dec. 2020**

- Demonstrated two optimal control methods, such as Pontryagin maximum principle (PMP) and pseudospectral method (LQR), on the model of F-4 aircraft. PMP method was better by 21 times in terms of optimizing time.

Incremental quasi-newton method with local superlinear convergence rate | *Python* **March 2020 - May 2020**

- Reconstructed the Incremental quasi-newton (IQN) method and applied IQN to a numerical experiment resulting in the gradient magnitude go to the order of 10^{-8}, significantly lower than algorithms such as Sequence Alignment by Genetic Algorithm (order of 10^{-5}).

Wind Aware Navigation | *POD, Modified A* Star, MATLAB* **May 2019 - Oct. 2019**

- Done feasibility analysis of a novel modified A* star algorithm for trajectory generation using wind characteristics. Conducted Monte-Carlo reachability analysis to validate safety.

Intruder UAVs avoidance using Grey Wolf Algorithm | *Heuristic Optimization, Netlogo* **March'19 - May'19**

- Designed a navigation framework using the Grey Wolf optimization algorithm to avoid intruder UAVs.

Autonomous car collision avoidance using Q-learning | *Reinforcement Learning, MATLAB* **Oct. 2018 - Dec. 2018**

- Implemented Q-Learning to train an autonomous car model to avoid collision while optimizing trajectory. Seventy iterations were needed to learn the offline policy that can guarantee 100 % safe navigation within 1.5m vision.

Development of robots | *SolidWorks, 3D Max, Arduino IDE, PSpice* **Jan. 2013 - Nov. 2015**

- Designed objective-directed 10+ IR sensor arrays, 3+ object grabbers, and necessary circuit boards to construct 7+ line following with obstacle avoidance and/or object grabbing autonomous robots and three object grabbing manual robots using Arduino Platform.

Publications

Accepted Journal Papers

- **S. M. N. Mahmud**, S. Nivison, Z. I. Bell and R. Kamalapurkar, "Safe Model-Based Reinforcement Learning for Systems with Parametric Uncertainties," *Frontiers in Robotics and AI*, 2021. Pre-print version: **https://arxiv.org/abs/2007.12666** DOI: **10.3389/frobt.2021.733104** **2021**

- R. V. Self, M. Abudia, **S. M. N. Mahmud** and R. Kamalapurkar, "Model-based inverse reinforcement learning for deterministic systems," To appear in *Automatica*, 2021. **2021**

Accepted Conference Papers

- **S. M. N. Mahmud**, K. Hareland, S. Nivison, Z. I. Bell and R. Kamalapurkar, "A Safety Aware Model Based Reinforcement Learning Framework for Systems with Uncertainties," *Proc. Am. Control Conf.*, New Orleans, USA, 2021 pp. 1979-1984. DOI: **10.23919/ACC50511.2021.9482976** **2021**

- R. V. Self, **S. M. N. Mahmud**, K. Hareland and R. Kamalapurkar, "Online Inverse Reinforcement Learning with Limited Data," *IEEE Conf. Decis. Control*, Jeju Island, Korea (South), 2020, pp. 603-608. **2020** DOI: **10.1109/CDC42340.2020.9303883**

Journal Papers under Review

- **S. M. N. Mahmud**, M. Abudia, S. Nivison, Z. I. Bell and R. Kamalapurkar, "Safety Aware Model-Based Reinforcement Learning for Optimal Control of a Class of Output-Feedback Nonlinear Systems," Submitted in *Automatica*, 2021. Pre-print version: **https://arxiv.org/abs/2110.00271** **2021**

- R. V. Self, M. Abudia, **S. M. N. Mahmud** and R. Kamalapurkar, "Online Inverse Reinforcement Learning for Systems with Sub-Optimal Trajectories," Submitted in *IEEE Trans. Neural Netw. Learn. Syst.*, 2021. **2021**

Poster Abstracts (Peer Reviewed)

- **S. M. N. Mahmud** and R. Kamalapurkar, "A Safety Aware Reinforcement Learning Approach for Dynamic Models with Uncertainties," *3rd annual MAE Graduate Research Symposium.* **Feb 2020**

- **S. M. N. Mahmud**, M. Harlen and R. Kamalapurkar, "A Hierarchical, Scale Separation Based Approached to Wind Aware Guidance and Control," *MAE Grad Student Recruiting Event 2020.* **Dec 2019**

Reviewer

- *Automatica* **2021-Current**
- *IEEE Control Letters* **2021-Current**
- *IEEE Transactions on Aerospace and Electronic Systems* **2021-Current**
- *Optimal Control Applications and Methods* **2021-Current**

Volunteer Activities

President, Bangaldesh Student Association, OSU. **Jan. 2021 - Current**
Public Relations Officer, Muslim Student Association, OSU. **May 2020 - May 2021**
Student Representative, ASME OSU Chapter. **Jan. 2020 - Dec. 2020**
Editor-in-Chief, CORE 2.0, Mecceleration. **Jan. 2015 - Dec. 2015**
Head of publications, Mecceleration. **Jan. 2015 - Dec. 2015**
Sub coordinator, Robotics, Mecceleration. **Jan. 2014 - Dec. 2015**