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*

Relevant courseworks: Intro to analysis, Advanced calculus, Linear systems analysis, Nonlinear systems control and analysis, Stochastic systems, Nonlinear optimization, Optimal control.

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

Relevant courseworks: Calculus (I-IV), Heat transfer (I-III), Numerical analysis, Fluid mechanics (I-III), Thermodynamics (I-III), HVAC, Mechanics (I-IV), Mechatronics, Renewable energy, Fossil fuel, Powerplant engineering.

Experience

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

- Currently, developing a local learning method for the deterministic continuous-time nonlinear systems.

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

- Developed and implemented 2 novel Model-Based Reinforcement Learning frameworks for safety-critical nonlinear systems with parametric uncertainties and partial output feedback, respectively.
- The frameworks incorporate barrier transformation to guarantee 100 % safe navigation for nonlinear systems.

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 4 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 2 novel Model-Based Reinforcement Learning frameworks with parametric uncertainties and partially observable nonlinear systems, respectively.
- 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 2 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**

- Conducted feasibility analysis of a novel modified A* star algorithm for trajectory generation using wind characteristics. Done Monte-Carlo analysis over 100+ generated trajectory to numerically verify the developed method and determine the gains' range.

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

- Implemented Grey Wolf optimizing algorithm to avoidsigned a sample banking transaction system using Java to simulate the common functions of using a bank account.

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. 70 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 3 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** **2021**

- R. V. Self, M. Abudia, **S. M. N. Mahmud** and R. Kamalapurkar, "Model-based inverse reinforcement learning for deterministic systems," Provisionally accepted 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** **2020**

- 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**
- *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**