

SHENGYUAN NIU

144 Durham Hall – 1145 Perry Street, Blacksburg, VA, 24060 · syniu97@vt.edu · (540)824-8163

EDUCATION

Virginia Polytechnic Institute and State University (Virginia Tech)

Blacksburg, Virginia

Ph.D. in Mechanical Engineering (Aug 2023 - present)

Advisor: Dr. Andrew J. Kurdila & Dr. Andrea L'Afflitto

M.S. in Mechanical Engineering (Aug 2021 - May 2023) GPA: 3.87

B.S. in Mechanical Engineering, Minor in Mathematics (cum laude) GPA: 3.45/4.0 (Major:3.48/4.0)

2020

COURSES

Graduate Level courses

Learning Theory for Dynamics, Learning Theory for Control, Adaptive Control System, Nonlinear System Theory, Applied Machine Learning, Calculus of Variation, Machine Learning for System Intelligence, Digital Signal Processing for Mechanical Measurements, Applied Linear Control, Applied Linear System, Robotics and Automation, Statistics in Research, Numerical Linear Algebra, Learning Theory Dynamics and Control

Undergraduate Level courses

Mechanical Design, System Dynamics, Control Engineering, Fluid Mechanics, Thermodynamics, Heat and Mass Transfer, Elementary of Materials Engineering, Engineering Electrical Theory, Manufacturing Process, Intro to C++

SOFTWARE SKILLS

MATLAB, Python, Solidworks, C++, Latex, Inventor, JMP, ANSYS-Fluent, Microsoft Package

RESEARCH INTEREST

Nonlinear Control Theory, Nonlinear Dynamic System, Optimal Control Theory, Reinforcement Learning, Deep Learning, Reproducing Kernel Hilbert Space, Approximation Theory

ORGANIZATIONS

T.E.K Robotic Club at Virginia Tech

Mechanical Design Team (Sep 2017 - May 2018)

Virginia Tech Chinese Soccer Club

Team Captain and Photographer (Aug 2021 - present)

RESEARCH EXPERIENCE

Ph.D Student

Virginia Tech
Jun 2023 - Present

Completed Research Topic

- Design a Matlab Reproducing Kernel Hilbert Space(RKHS) Toolbox
- Design an online critic algorithm to find the optimal control of a nonlinear dynamics systems with RKHS
- Discover the convergence rate of the error bound of the approximated value function by above algorithm and fill distance of RKHS centers

Current and Future Research Topic

- Design offline Policy-Iteration algorithm to find the optimal control by solving the Hamilton-Jacobi-Bellman Equation with adaptive RKHS basis method
- Design an online critic-actor algorithm to find the optimal control of a nonlinear dynamics systems with adaptive RKHS basis method
- Study the dynamics of underwater vehicles(VT-690) and hydrofoil and design/implement the optimal controller based on them

TEACH EXPERIENCE

Graduate Teaching Assistant - ESM 2304 Dynamics

(2024 Fall)

- Hold office hours to help students with their questions on lecture notes, homework, and tests.

PROJECTS

SOLAR POWERED LINE ROBOT FOR VIBRATION CONTROL (Senior Design Project)

Virginia Tech, 2019
Dr. Oumar Barry

- Design the inner electrical circuit diagram of the robot which includes the solar power system, battery charging system, motor driver controller.
- Select the best components solution of the robot including the solar panels, battery charge controller and battery and check the energy efficient
- Design the PD control loop and program the Arduino code for driving the robot and locating the position with the motors and encoders.
- Build the locomotion part of the prototype which includes soldering the motors with the encoders and connecting them with the main controller and power supplier components.
- Design and build the test environment for the robot which includes the test bench with the power cable.

Hybrid Dynamic Systems and Robot Locomotion Laboratory

Virginia Tech, 2019
Dr. Kaveh Akbari Hamed

- Build a CAD model and 3D printed the model which fixed a 4 DOF manipulate on a 4 legged robot.
- Work on motion capture sub-team to build up a system to capture the motion behavior of legged robot.
- Set up the test environment including the robot testing bench and experiment recording equipment.

T.E.K Robotic Club

Virginia Tech, 2017

- Design and built the 2017 competition VEX robot.
- Build the CAD model of the competition robot.
- Design and built some small robots for community volunteer events.

SERVICE ACTIVITIES

Reviewer, Conferences

| | |
|---|----------------|
| IEEE Conference on Decision and Control (CDC) | (2024-present) |
| American Control Conference (ACC) | (2024-present) |

JOURNAL PUBLICATIONS

1. **Shengyuan Niu**, Ali Bouland, Haoran Wang, Filippos Fotiadis, Andrew Kurdila, Andrea L'Afflitto, Sai Tej Paruchuri, and Kyriakos G. Vamvoudakis. Convergence rates of online critic value function approximation in native spaces. *IEEE Control Systems Letters*, pages 1–1, 2024
2. Ali Bouland, **Shengyuan, Niu**, Sai Tej Paruchuri, Andrew Kurdila, John Burns, and Eugenio Schuster. Rates of convergence in a class of native spaces for reinforcement learning and control. *IEEE Control Syst. Lett.*, 8:55–60, 2024

CONFERENCE PUBLICATIONS

1. **Shengyuan, Niu**, Ali Bouland, Haoran Wang, Filippos Fotiadis, Andrew Kurdila, Andrea L'Afflitto, Sai Tej Paruchuri, and Kyriakos G. Vamvoudakis. Convergence rates of online critic value function approximation in native spaces. *Accepted by to IEEE Conference on Decision and Control*, 2024
2. Nathan Powell, Sai Tej Paruchuri, Ali Bouland, **Shengyuan, Niu**, Andrea L'Afflitto, and Andrew J. Kurdila. A new result on invariance and approximation of koopman operators for discrete dynamics in native spaces. *Accepted by International Symposium on Mathematical Theory of Networks and Systems*, 2024
3. Nathan Powell, Sai Tej Paruchuri, Ali Bouland, Shengyuan Niu, and Andrew Kurdila. Invariance and approximation of koopman operators in native spaces. In *2024 American Control Conference (ACC)*, pages 2871–2878. IEEE, 2024
4. Ali Bouland, **Shengyuan, Niu**, Sai Tej Paruchuri, Andrew Kurdila, John Burns, and Eugenio Schuster. Rates of convergence in a class of native spaces for reinforcement learning and control. *Accepted by IEEE American Control Conference*, 2024