

KHAI NGUYEN

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EDUCATION

Carnegie Mellon University, Pittsburgh, PA, US

May 2024

Master of Science in Mechanical Engineering – Research Program

- GPA: 4.0/4.0; Vingroup Scholar

ETH Zürich, Zürich, Switzerland

Summer 2023

Robotics Summer School and Robotics Student Fellowship Programs

Hanoi University of Science and Technology, Hanoi, Vietnam

Oct 2021

Bachelor of Science in Control Engineering and Automation – Talent Program

- GPA: 3.85/4.0 (top 1% university)

PUBLICATIONS

* denotes alphabetical authorship

- A. Alavilli*, K. Nguyen*, S. Schoedel*, B. Plancher, Z. Manchester, “TinyMPC: Model-Predictive Control on Resource-Constrained Microcontrollers,” **in review**, *International Conference on Robotics and Automation (ICRA)*, 2024. [[arxiv](#)][[website](#)][[video](#)]
- K. Nguyen, V. T. Dang, D. D. Pham, and P. N. Dao, “Hierarchical Formation Control Scheme with Reinforcement Learning for Multi-Vessel Systems,” *International Journal of Robust and Nonlinear Control*, 2023. [[online](#)]
- P. N. Dao, D. D. Pham, K. Nguyen, and T. C. Nguyen, “Adaptive Reinforcement Learning Motion/Force Control of Multiple Uncertain Manipulators,” *Intelligent Systems and Networks*, 2021. [[online](#)]
- K. Nguyen, A. Le, T. D. Nguyen, and K. T. Nguyen, “Output DC Voltage Stabilizer and Efficiency Improvement in Wireless Power Transfer Systems,” *Measurement, Control, and Automation*, 2021. [[online](#)]

HONORS AND AWARDS

- **ETH Zürich Robotics Student Fellowship, 2023:** Awarded to 8 world-wide students for summer research.
- **ETH Zürich Robotics Summer School, 2023:** Awarded to 50 world-wide students for summer school.
- **Vingroup Scholarship, 2022**, by Vingroup: Full-ride scholarship for graduate studies.
- **Honda Scholarship, 2021**, by Honda Foundation: Awarded to 100 outstanding students nation-wide.
- **Top 15 Finalists of The Honda Young Engineer and Scientist’s Award, 2021**, by Honda Foundation.
- **CCU Virtual Internship Program, 2021**, by National Chung Cheng University, Taiwan.
- **University Academic Scholarship, 2018, 2019, 2020, 2021**, by HUST: Awarded to top 1% GPA students.
- **Global Project-Based Learning Program, 2020**, by Shibaura Institute of Technology, Japan.
- **Acecook Happy Scholarship 2020**, by Acecook Vietnam: Awarded to outstanding students.
- **Top 2 Best Oral Presentation Award**, at the Student Forum 2020 – Renewable Energy.
- **Best Poster Award**, at the 37th Student Research Conference, 2020, by HUST.

RESEARCH AND WORK EXPERIENCE

Robotic Exploration Lab, CMU, Pittsburgh, PA, US

Sep 2022 – Present

Graduate Research Assistant, advised by Prof. Zachary Manchester

- Investigating local planning and control frameworks for autonomous driving using MPC to ensure safe and efficient trajectory, while handling control limits and obstacles.
- Co-leading [TinyMPC](#), a high-speed MPC solver based on ADMM with low memory footprints, outperforming existing solvers and demonstrating real-world efficacy on nano-quadrators; collaborated with [Prof. Brian Plancher](#).
- Developing a differentiable MPC framework embedding implicit neural networks, enabling joint inference and input optimization for solving complex robotic problems.
- Exploring a new navigation stack from a learned library of perceptive low-level skills for agile quadruped robots.

Robotic System Lab, ETH Zürich, Zürich, Switzerland

Jul 2023 – Aug 2023

Research Assistant, advised by [Dr. Jesus Tordesillas](#) and [Prof. Marco Hutter](#)

- Proposed a framework to enforce hard convex constraints on neural networks through differentiable optimization.
- Employed the proposed framework to learn control barrier function-based safety filters with various constraints (linear, quadratic, and second-order cone).

Advanced Control and Robotics Group, HUST, Hanoi, Vietnam

Mar 2019 – Aug 2022

Research Assistant, advised by [Prof. Phuong Nam Dao](#)

- Explored motion/force robust controller for multiple mobile manipulators to accomplish cooperative tasks.
- Integrated control theory to boost the adaptability and robustness of reinforcement learning algorithms by 66%.
- Formulated hierarchical formation control for multi-agent systems; scaled up and simulated with Matlab/Simulink.

Viettel Aerospace Institute (VTX), Hanoi, Vietnam

Aug 2020 – May 2022

Autopilot Engineer and Intern

Designed, built, and operated a prototype autopilot system for high-speed aerial vehicles with multiple teams.

- Investigated guidance and control; tuned attitude controller to reduce settling time and overshoot by 30% and 35%.
- Implemented controllers in embedded systems including STM32 ARM (C/C++) and Altera/Xilinx FPGA (VHDL).
- Authored one peer-reviewed article in the Institute Journal on modern control design for pneumatic actuators.

Advanced Power Electronic System Lab, HUST, Hanoi, Vietnam

Nov 2019 – Feb 2021

Research Assistant, advised by [Prof. Trung Kien Nguyen](#)

- Led a team to develop wireless power transfer, static and dynamic wireless charging systems for electric vehicles.
- Tested prototype wireless charging systems (66-80% efficiency); compared it with simulation (90% efficiency).
- Proposed Extended Kalman Filter to dynamically estimate vehicle states and parameters; achieved 90% accuracy.

TALKS

- **TinyMPC: Model-Predictive Control on Resource-Constrained Microcontrollers** Nov 2023
Robotic Exploration Lab, CMU, Pittsburgh, PA, US. [[slides](#)]
- **Enforcing Non-Fixed Hard Convex Constraints on Neural Networks and Its Applications** Aug 2023
Robotic System Lab, ETH Zürich, Zürich, Switzerland. [[slides](#)]
- **Areas with More Motivation to Develop in the Pandemic** Nov 2021
AOTULE Student Conference (virtual), KAIST, Korea. [[event](#)] [[slides](#)]

TEACHING

- **Assistant, CMU 24-774 Advanced Control Systems Integration**, with [Prof. Mark Bedillion](#), graduate level, F2023.
- **Instructor, GSTT Initiative**: Taught advanced STEM subjects to students for the talent program exams, 2018.

EXTRACURRICULARS

- **Member, Carnegie Autonomous Racing**: Co-led the F1TENTH team finishing at 4/12 in the CPS2023 race, 2023.
- **Member, MIT-PITT-RW**: Verified GPU-based MPPI controller on optimal planning and obstacle avoidance, 2023.
- **Organizer, European Union**: Organized European music concerts to promote cultural exchanges, Vietnam, 2019.
- **Interpreter, Plan International**: Visited remote areas to raise awareness of child rights and safety, Vietnam, 2019.

SKILLS

- **Domains**: Optimization, Planning and Control, State Estimation, Dynamics, System ID, Machine Learning.
- **Programming**: C/C++, Python, Julia, Matlab, LaTeX.
- **Software**: Git, Simulink, Eigen, ROS 1/2, PyTorch, JAX, Drake, OCS2, MuJoCo, IsaacGym, Gazebo, CARLA, CoppeliaSim, Trello.
- **Robots**: Crazyflie, F1TENTH AVs, SuperMegaBot UGVs, Unitree Go1, ANYmal (sim), INDY AVs (sim).