Mahdi Shahrajabian

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A passionate researcher in control theory and AI, dedicated to developing safe data-driven algorithms for planning and control in safety-critical autonomous systems

Research Interests

Control Theory, Safe Learning-Based Control, Assured Autonomy in Safety-Critical Systems, Multi-agent Systems

Education

Master of Science in Aerospace Engineering (Dynamics and Control) — **Tehran, Iran**
Sharif University of Technology (SUT) — *2022–2025*
CGPA: 19.4/20.0 (4-point scale CGPA: 4.0/4.0)

Bachelor of Science in Aerospace Engineering (Dynamics and Control) — **Tehran, Iran**
Amirkabir University of Technology - Tehran Polytechnic (AUT) — *2017–2022*
CGPA: 18.1/20.0 (4-point scale CGPA: 3.86/4.0 and last six semester GPA: 4.0/4.0)

Bachelor of Science in Electrical Engineering (Control Systems) — **Tehran, Iran**
Amirkabir University of Technology - Tehran Polytechnic (AUT) — *2017–2022*
CGPA: 17.8/20.0 (4-point scale CGPA: 3.64/4.0)

Work & Research Experiences

Graduate Research Assistant — **Tehran, Iran**
Department of Aerospace Engineering, SUT — *Jan 2024 – Sep 2025*
Supervisor: Prof. Fariborz Saghafi

Master's Thesis: Fault-Tolerant Adaptive Intelligent Control of an Autonomous Multi-rotor eVTOL Air Taxi

- Developed a detailed simulation model for an octodecarotor eVTOL air taxi
- Proposed a Composite-Learning-Based Adaptive Neural Control with Disturbance Observer (CANCDO) approach considering input constraints for multirotors to achieve robust trajectory tracking under uncertainties and disturbances.
- Developed a dynamic control allocation algorithm based on a novel two-stage Fault Detection and Diagnosis (FDD) framework, combining AEKF and OS-ELM approaches to handle simultaneous actuator faults.
- Developed adaptive CBFs as safety filter for guaranteeing operation within safe flight envelopes.

Undergraduate Research Assistant — **Tehran, Iran**
Hardware-in-the-Loop Lab, Department of Aerospace Engineering, AUT — *May 2021 – Sep 2022*
Supervisor: Dr. Seyed Majid Esmailifar

Bachelor's Thesis: Design and Implementation of Autopilot for Automatic Takeoff and Landing of a Quadrotor using the Model-Based Design Approach

- Designed and implemented flight management, waypoint following and control algorithms for the quadrotor
- Implemented custom automatic flight control algorithms on the Pixhawk using Simulink
- Performed Software-in-the-Loop (SIL) simulation, Hardware-in-the-Loop (HIL) simulation and flight tests for verification of custom-designed autopilot using Simulink and the Pixhawk

Embedded Software Engineer (Part-time) — **Tehran, Iran**
Avionics Office, ARC Aerosystems Ltd. — *Oct 2021 – Sep 2022*

- Conducted a comprehensive survey of basic standards for the design of aircraft Flight Control Computer (FCC)
- Setting up embedded systems communication protocols with TI C2000 microcontroller
- Created an intuitive GUI for eVTOL aircraft simulation using MATLAB app designer

Engineering Intern — **Tehran, Iran**
Avionics Office, ARC Aerosystems Ltd. — *Jul 2021 – Sep 2021*

- Gained expertise in utilizing Pixhawk autopilot and PX4 firmware
- Acquired proficiency in working with QGroundControl
- Compared and evaluated various control methods employed in control system of a lift + cruise eVTOL aircraft.

Publications

1. **Shahrajabian, M.**, Saghafi, F. (2025). Fault-tolerant Composite Adaptive Neural Control with Safety Guarantees for Autonomous Multirotors in UAM. *Control Engineering Practice* (To be submitted)

2. **Shahrajabian, M.**, Otroushi, H., Emami, S. A. (2026). End-To-End Deep Reinforcement Learning for Minimum-Time Aerial Manipulation in Cluttered Environments (in progress)

Teaching Experiences

Teaching Assistant, Sharif University of Technology

- AE 45-787: Principles of Machine Learning (Undergraduate/Graduate) *Spring 2025*
- AE 45-765: Optimal Control Theory (Graduate) *Fall 2024*
- AE 45-113: Dynamics *Fall 2024, Fall 2023*
- AE 45-135: Automatic Control *Spring 2024*

Teaching Assistant, Amirkabir University of Technology

- EE 23-84543: Intelligent Control and Fault Diagnosis (Graduate) *Spring 2025*
- EE 23-56113: Modern Control *Fall 2024, Fall 2023, Fall 2022*
- AE 29-05343: Automatic Control *Spring 2023*

Instructor, Amirkabir University of Technology

- EE 23-02241: Linear Control Systems Lab *Spring 2024*
- Advanced MATLAB and Simulink *Summer 2024*
- Introduction to MATLAB for Engineers *Spring 2024*

Honors & Awards

- Ranked 1st among all 64 peer master's students in the Aerospace Engineering Department at SUT (Sep 2024)
- Winner of the Academic Excellence Fellowship from Iran's National Elite Foundation (Jan 2023)
- Received a merit-based direct admission offer for the Master of Aerospace Engineering at SUT (Feb 2022)
- Ranked 3rd among all 71 bachelor's students in the Aerospace Engineering Department at AUT (Nov 2020)
- Recognized as an outstanding student (exceptional talent) and granted the opportunity to pursue Electrical Engineering as a second major during my BSc at AUT (Sep 2019)
- Ranked within the top 1.3% among more than 148000 participants in the 2017 Iranian University Entrance Exam issued by the National Organization for Educational Testing (Aug 2017)

Selected Academic Projects

Nonlinear Control Jan 2024 – Jun 2024

Nonlinear Fault-tolerant control of a quadrotor using an OS-ELM-based actuator LoE fault estimator

Supervisor: Dr. Seyyed Ali Emami

Intelligent Control Jan 2023 – Jun 2023

Robust fault-tolerant trajectory tracking of a quadrotor based on learning-based adaptive model predictive control

Supervisor: Dr. Seyyed Ali Emami

Optimal Control Theory Jan 2023 – Jun 2023

Optimal attitude control of a tri-axial air-bearing satellite simulator platform

Supervisor: Prof. Seid H. Pourtakdoust

Digital Control Systems Jan 2022 – Jun 2022

- *Implementation of discrete-time PID controller on Raspberry Pi for motion control of a wheeled mobile robot*
- *Control system design for a two-robot soccer game in Webots*

Supervisor: Prof. Heidar Ali Talebi

Instrumentation Mar 2021 – Jun 2021

Smart Home Lighting: Energy-efficient brightness adjustment based on ambient light and movement detection

Supervisor: Dr. Iman Sharifi

Computational Intelligence Nov 2020 – Dec 2020

- *Fuzzy Logic Control of a three-link gymnastic robot (Teamwork-Leader)*
- *Adaptive cruise control of an autonomous vehicle based on self-tuning fuzzy PID control*
- *System identification of robotic manipulator using neural networks*

Supervisor: Prof. Farzaneh Abdollahi

Languages

- **Persian:** Mother Tongue
- **English:** Fluent (The TOEFL test will be taken on November 20th, 2025)

Skills

- **Programming:** MATLAB (Script, Simulink, Stateflow), Python (Numpy, TensorFlow, Keras, Gym), C, C++
- **Engineering Softwares:** Solidworks, Ansys Fluent, XFLR5, AVL, OpenVSP, QGroundControl, PX4 firmware, CIFER, Keil uVision, STM32 CubeMX, Code Composer Studio, Proteus, Arduino
- **General:** Windows, Ubuntu, Microsoft Office Collection, Git, LaTeX

Voluntary Experience

Contributing Author Aug 2023 – Dec 2023

Book: Emami, S. A., Castaldi, P., Narimani, M., Ezabadi, M., *Neural Network-based Control Systems with Application to Flight Control: From Classical Neural Control to Reinforcement Learning.* (in preparation)

Responsibilities: Designing multiple examples, writing the solutions, conducting the corresponding simulations, analyzing the results, and drawing conclusions

Notable Courses

- **Related Courses in M.Sc.**
  - ◇ Advanced Automatic Control (1st rank)
  - ◇ Nonlinear Control (1st rank)
  - ◇ Optimal Control 1 (1st rank)
  - ◇ Optimal Control 2 (1st rank)
  - ◇ Intelligent Control (3rd rank)
  - ◇ Deep Reinforcement Learning (1st rank)
  - ◇ Advanced Mathematics
  - ◇ System Identification (1st rank)
  - ◇ Advanced Flight Dynamics and Control (1st rank)
  - ◇ Modeling of Aerospace Dynamic Systems
  - ◇ Flight Simulation (1st rank)
- **Related Courses in B.Sc.**
  - ◇ Linear Control Systems + Lab (1st rank)
  - ◇ Applied Linear Algebra (1st rank)
  - ◇ Computational Intelligence + Lab (2nd rank)
  - ◇ Digital Control Systems + Lab
  - ◇ Modern Control (2nd rank)
  - ◇ Industrial Control + Lab
  - ◇ Mechatronics
  - ◇ Avionics + Workshop
  - ◇ Flight Dynamics + Lab (1st rank)
  - ◇ Aircraft Design (1st rank)
  - ◇ Satellite Systems (1st rank)
  - ◇ Computational Fluid Dynamics (1st rank)
- **Coursera**
  - ◇ Machine Learning Specialization (Certificate)
  - ◇ Robotics Specialization (Audited)
- **Others**
  - ◇ Artificial Intelligence and Deep Learning (Certificate)
  - ◇ ETHZ Computational Control (Course page)

References

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