# Ali BaniAsad

Curriculum Vitae

**Contact Information**
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## EDUCATION

**M.S.** Aerospace Engineering — September 2022 – November 2024 (Expected)
*Sharif University of Technology*

**B.S.** Aerospace Engineering — September 2017 – May 2022
*Sharif University of Technology*

## RESEARCH INTERESTS

- Robotics
- Multi-Agent Systems
- Game Theory
- Reinforcement Learning
- Automatic Control
- Embedded ML

## PUBLICATIONS

### Journal Papers

- **Ali BaniAsad**, Alireza Sharifi, Reza Pordal, Hadi Nobahhari. "Attitude Control of a 3-DoF Quadrotor Platform Using a Linear Quadratic Integral Differential Game Approach." *ISA Transactions, Elsevier*, 2024.
- Alireza Sharifi, **Ali BaniAsad**. "Robust In-Motion Transfer Alignment of Low-Grade Inertial Navigation Systems with Recurrent Neural Networks in the Event of Reference Malfunction." *IEEE*, 2024 (Active)
- **Ali BaniAsad**, Hadi Nobahhari. "Robust Differential Game Reinforcement Learning with Soft Actor-Critic for Guidance in Low-Thrust Multi-Body Environments." *AIAA*, 2024 (Active)
- **Ali BaniAsad**, Alireza Sharifi. "Enhancing AHRS Results with Deep Learning LSTM Networks for Real-Time Attitude Estimation in GNSS-Denied Environments." *Engineering Applications of Artificial Intelligence*, 2024 (Active)

### Conference Papers

- Hadi Nobahhari, **Ali BaniAsad**, Alireza Sharifi. "Linear Quadratic Integral Differential Game Applied to the Real-time Control of a Quadrotor Experimental Setup." *ICRoM, IEEE*, 2022.

## RESEARCH EXPERIENCE

**Researcher at CNAV Lab** May 2020 – Ongoing
*Head of Lab (Current), Researcher (Former)* Tehran, Iran
Supervisors: Hadi Nobahari, PhD and Alireza Sharifi, PhD

- Integrated **embedded AI** with C programming to enhance **robotic control** system efficiency.
- Designed **RL** algorithms to enhance robotic **navigation**, **decision-making**, and adaptability.
- Developed AI-driven navigation systems (INS-AI, AHRS-AI) to enhance **precision**, **safety**.
- Employed **ROS** for inter-robot networking and swarm flight in **multi-agent** Crazyflie drones.
- Validated AI navigation in **real-world** applications to ensure **robustness** and **reliability**.

**Robust Reinforcement Learning Guidance** August 2022 – November 2024 (Expected)
*Master's Thesis in Sharif University of Technology* Tehran, Iran
Supervisors: Hadi Nobahari, PhD

- Investigated **Deep Reinforcement Learning** methods, comparing their performance with classical strategies, such as **MPC**, to identify strengths and weaknesses.
- Integrated **ROS** to test and validate robotic **Embedded RL** in **real-world** scenarios.
- Utilized **game theory** to develop **robust** and **safe multi-agent** RL algorithms.
- Simulated and evaluated the **robustness** of proposed methods, demonstrating their effectiveness in maintaining **safety** and **optimizing** performance under **dynamic constraints**.

**Game Theory-Based Control for a UAV** February 2021 – September 2023
*Bachelor's Thesis in Sharif University of Technology* Tehran, Iran
Supervisors: Hadi Nobahari, PhD
***Awarded the Best Undergraduate Thesis***

- Developed a robust **quadrotor** control system using **differential game theory**, applying **Nash equilibrium** to solve the game and optimize performance under **uncertainty**.
- Employed **optimization** for **system identification**, enhancing control **reliability**.
- Evaluated system performance via **simulations**, ensuring the validity of theoretical **model**.
- Tested the control strategy on a 3DoF setup, demonstrating the **game-theoretic** approach.
- Conducted experiments to assess the setup's **stability**, refining algorithms based on feedback.

**Optimized Flocking of Autonomous Drones** July 2023
*Project in Sharif University of Technology* Tehran, Iran
Supervisors: Hadi Nobahari, PhD
***Top Score Project***

- Developed and optimized a swarm model for flocking behavior, addressing **communication delays**, environmental obstacles, and enhancing coordination and **obstacle avoidance**.
- Implemented and validated the model with **Simulink** simulations and **HIL** testing using **embedded C** on a **microcontroller**, ensuring robustness and reliability.

**Multi-Objective Heuristic Optimization** February 2023
*Project in Sharif University of Technology* Tehran, Iran
Supervisors: Hadi Nobahari, PhD
***Top Score Project***

- Implemented the REMARK algorithm for **multi-objective optimization** with **conflicting** objectives, allowing for the effective evaluation of trade-offs.
- Utilized **heuristic** methods to achieve high approximations of the **Pareto set**, balancing multiple objectives for optimal decision-making.

**Advanced Aircraft Trim Stability Analysis with DATCOM** March 2022
*Project in Sharif University of Technology* Tehran, Iran
Supervisors: Afshin Banazadeh, PhD
***My Top Star Repository***

- Developed an advanced **UI** for DATCOM software, enhancing aircraft **stability analysis**.
- **Real-Time** visualization and **interactive** adjustments for aircraft performance **evaluation**.
- Validated the UI for reliability, **optimizing** the **design process** for engineers and researchers.

**AIAA Regional Jet Design Competition** June 2021
*Project in Sharif University of Technology [Poster of the Aircraft]* Tehran, Iran
Supervisors: Afshin Banazadeh, PhD
***Top Group Project for Two Semesters***

- Led regional jet design, integrating disciplines for performance and **industry standards**.
- Developed a project report and presentation, highlighting **design choices** and simulation results, leading to a successful team presentation.
- Applied **computer modeling** for aerodynamic, structural, and performance analysis.
- Developed an **automated design cycle** that allows for seamless updates across all stages.

## TEACHING EXPERIENCE

### Teaching Assistant

- **Automatic Control** September 2021 – Present
  *Department of Aerospace Engineering, Sharif University of Technology*
  Instructors: Hadi Nobahari, PhD and Alireza Sharifi, PhD

- **Control Lab** September 2021 – Present
  *Department of Aerospace Engineering, Sharif University of Technology*
  Instructors: Hadi Nobahari, PhD and Alireza Sharifi, PhD

- **Dynamics** September 2021 – December 2023
  *Department of Aerospace Engineering, Sharif University of Technology*
  Instructors: Alireza Sharifi, PhD

- **Introduction to Aerospace Engineering** September 2021 – December 2023
  *Department of Aerospace Engineering, Sharif University of Technology*
  Instructors: Alireza Sharifi, PhD

- **Aircraft Design II** September 2021 – December 2021
  *Department of Aerospace Engineering, Sharif University of Technology*
  Instructors: Afshin Banazadeh PhD

- **Fundamentals of Programming (C/C++)** September 2018 – December 2018
  *Department of Computer Engineering, Sharif University of Technology*
  Instructor: Ms. Marjan Nikbin

## SELECTED AWARDS AND HONORS

**Ranked 23** 2017

*Ranked 23 among more than thousands participants in the Nationwide University Entrance Exam for Aerospace Engineering.*

**Iranian Aerospace Society's Best Undergraduate Thesis Award** 2022

*Awarded for the exceptional undergraduate thesis titled "Control of a 3DOF Quadrotor Stand using a Linear-Quadratic-Integral Controller based on Differential Game Theory".*

**Ranked Top 0.5%** 2017

*Ranked Top 0.5% among 150,000 participants of Iran's Undergraduate University Entrance Exam*

## TECHNICAL SKILLS

- **Programming Languages**
  - C/C++
  - Embedded C
  - MATLAB
  - Python
- **Tools and Platforms**
  - Git
  - ROS
  - Terminal
  - Linux
  - Simulink
  - LaTeX
- **Libraries/Frameworks:**
  - **Machine Learning Libraries:** PyTorch, TensorFlow, Keras, Scikit-learn, OpenAI Gym, JAX
  - **Data Analysis and Visualization Libraries:** Matplotlib, NumPy, Pandas, OpenCV
  - **Simulation Tools:** Gazebo, MuJoCo
- **Languages:** Farsi (Native), English (Full Professional Proficiency)
  The TOEFL iBT score is 96 (Reading: 26, Listening: 27, Speaking: 22, Writing: 21)

## NOTABLE COURSES

**University Courses** 2017 – 2024
*Sharif University of Technology, Tehran, Iran*

- **Programming and Computational Methods:**
  - Basic Programming of C (20)
  - Numerical Calculations (20)
- **Mathematics and Statistics:**
  - Engineering Mathematics (19.8)
  - Probability and Statistics (20)
- **Control Systems:**
  - Automatic Control (18.1)
  - Optimal Control (17.5)
  - Control Lab (18.5)
- **Aerospace Engineering:**
  - Aircraft Design II (18.3)
  - Flight Dynamics II (18.3)
- **Research and Projects:**
  - Bachelor Thesis (20)

**Online Courses** 2017 – 2024

- **Robotics:**
  *Provided by University of Pennsylvania, Courser* verify certificate
  - Aerial Robotics
  - Computational Motion Planning
  - Mobility
  - Perception
  - Estimation and Learning
  - Capstone
- **Reinforcement Learning:**
  *Provided by University of Alberta, Coursera* verify certificate
  - Fundamentals of Reinforcement Learning
  - Sample-based Learning Methods
  - Prediction and Control with Function Approximation
  - A Complete Reinforcement Learning System
- **IBM AI Engineering:**
  *Provided by IBM, Coursera*
  - Machine Learning with Python
  - Introduction to Deep Learning and Neural Networks with Keras
  - Building Deep Learning Models with TensorFlow
  - Introduction to Neural Networks and PyTorch
  - Introduction to Computer Vision and Image Processing
  - AI Capstone Project with Deep Learning
- **Neural Networks and Deep Learning:**
  *Provided by deeplearning.ai, Coursera* verify certificate
- **Python Data Structures:**
  *Provided by University of Michigan, Coursera* verify certificate
- **Introduction to Embedded Machine Learning:**
  *Provided by Edge Impulse, Coursera* verify certificate
- **Game Theory:**
  *Provided by Stanford University, Coursera* verify certificate

## HOBBIES

- Violin
- Classical Music
- Reading
- Coding
- Swimming
- Hiking
- Traveling
- Photography
- Chess

## REFERENCES

- **Sharifi, Alireza, PhD**
  Assistant Professor of Aerospace Engineering, Sharif University of Technology
  Dr. Sharifi Supervised my work in the CNAV Lab for over three years, during which we collaborated on multiple projects. I served as both a researcher and a teaching assistant during this time.
  - Faculty Page at Sharif University
  - Google Scholar Profile
  - ar.sharifi@sharif.edu
  - (+98)-21-6616-8115

- **Nobahari, Hadi, PhD**
  *Professor of Aerospace Engineering, Sharif University of Technology*
  I have worked with Dr. Nobahari for over four years, including on both my master's and bachelor's theses.
  - Faculty Page at Sharif University
  - Google Scholar Profile
  - nobahari@sharif.edu
  - (+98)-21-6616-4040

- **Banazadeh, Afshin, PhD**
  *Professor of Aerospace Engineering, Sharif University of Technology*
  I have taken several courses with Dr. Banazadeh, achieving excellent results. I developed a fully designed regional jet and created a GUI to facilitate and automate the design process. Additionally, I served as a teaching assistant for the "Airplane Design II" course for one year.
  - Faculty Page at Sharif University
  - Google Scholar Profile
  - banazadeh@sharif.edu
  - (+98)-21-6616-8108