

# Ali BaniAsad

## Curriculum Vitae

### Contact Information

✉ Email: alibaniasad1999@yahoo.com

☎ Phone: (+98) 991-214-7276

🌐 LinkedIn: alibaniasad1999

🐙 GitHub: alibaniasad1999

### EDUCATION

**M.S. Aerospace Engineering**  
*Sharif University of Technology*

Sep. 2022 – Nov 2024 (Expected)

**B.S. Aerospace Engineering**  
*Sharif University of Technology*

Sep. 2017 – May 2022

### RESEARCH INTERESTS

- **Robotics**

- **Reinforcement Learning**

- \* Multi-Agent Systems
    - \* Optimal Control in RL
    - \* Policy Optimization

- **Computer Vision**

- \* Object Detection
    - \* Sensor Fusion
    - \* Image Segmentation
    - \* 3D Reconstruction

- **Artificial Intelligence**

- Machine Learning

- Artificial Neural Networks
  - Deep Learning
  - Natural Language Processing

- **Control Systems**

- Optimal Control
  - Automatic Control
  - Robust Control

- **Game Theory**

- Differential Game
  - Multi-Agent Game
  - Cooperative Game Theory
  - Non-Cooperative Game Theory

## 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

- Led projects focusing on the integration of embedded AI using C programming for the development of advanced robotic control systems, enhancing overall system efficiency and performance.
- Designed and implemented reinforcement learning (RL) algorithms to optimize robotic navigation and decision-making processes, significantly improving adaptability in dynamic environments.
- Developed advanced quadrotor technology with AI-driven navigation systems, including INS-AI and AHRS AI, resulting in enhanced precision, safety, and operational reliability during complex missions.
- Collaborated with interdisciplinary teams to integrate Robot Operating System (ROS) frameworks, streamlining development processes and ensuring effective communication across project stakeholders.
- Conducted rigorous testing and validation of AI navigation systems, utilizing real-world simulations to ensure robustness and reliability under various operational conditions.

**Robust Reinforcement Learning Guidance** 

August 2022 – November 2024

*Master's Thesis in Sharif University of Technology*


Tehran, Iran

Supervisors: Hadi Nobahari, PhD

- Investigated various reinforcement learning methods, comparing their performance to classic control strategies to identify advantages and limitations.
- Integrated Robot Operating System (ROS) to implement and test real-world robotic systems, validating performance in practical scenarios.
- Utilized differential game theory to develop robust and safe reinforcement learning algorithms, enhancing decision-making and trajectory planning in complex environments.
- Developed safety protocols and mechanisms to ensure reliable operation of robotic systems in uncertain conditions, focusing on minimizing risk during navigation and task execution.
- Conducted simulations to evaluate the robustness of the proposed methods, demonstrating their effectiveness in maintaining safety while 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

- Developed a robust control system for a quadcopter using differential game theory, employing Nash equilibrium to optimize controller performance under uncertainty.
- Evaluated system performance through extensive Simulink simulations, ensuring the theoretical models translated effectively to real-world applications.
- Implemented and tested the control strategy on a three-degree-of-freedom setup, demonstrating the efficacy of the game-theoretic approach in practical scenarios.
- Conducted a series of experiments to assess the quadcopter's stability and responsiveness, refining the control algorithms based on performance feedback.

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

- Developed a UAV swarm model optimizing flocking behavior under real-world constraints, utilizing Embedded C for control algorithms and addressing challenges such as communication delays and environmental obstacles.
- Implemented and validated the model with Simulink simulations and Hardware-in-the-Loop (HIL) testing using a microcontroller, ensuring robustness and reliability in practical applications.
- Employed optimization techniques to enhance swarm performance, focusing on coordination and obstacle avoidance strategies.

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

- 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

- Developed an advanced user interface (UI) for DATCOM software, streamlining the analysis workflow for aircraft trim stability assessments and enhancing user experience through intuitive design.
- Integrated features such as real-time data visualization and interactive parameter adjustments, allowing for more accurate and efficient evaluations of aircraft performance under various flight conditions.
- Conducted thorough testing and validation of the UI to ensure reliability and precision in output, significantly improving the design process for engineers and researchers.

## **AIAA Regional Jet Design Competition**

June 2021

*Project in Sharif University of Technology* [*Poster of Aircraft*]

Tehran, Iran

Supervisors: Afshin Banazadeh, PhD

- Led the comprehensive design of a regional jet, integrating various engineering disciplines to ensure optimal performance and compliance with industry standards.
- Utilized MATLAB and Python for complex computer modeling, including aerodynamic analysis, structural assessments, and performance simulations.
- Developed a detailed project report and presentation, showcasing design choices and simulation results, which facilitated a successful team presentation at the competition.
- Collaborated with a multidisciplinary team to refine design concepts, ensuring effective communication and integration of ideas throughout the project lifecycle.

## 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
- **Aircraft Design II** September 2021 – December 2021  
*Department of Aerospace Engineering, Sharif University of Technology*  
Instructors: Afshin Banazadeh 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
- **Fundamentals of Programming (C/C++)** September 2018 – December 2018  
*Department of Computer Engineering, Sharif University of Technology*  
Instructor: Ms. Marjan Nikbin

## AWARDS AND HONORS

- Ranked 23** 2017  
*Ranked 23 among more than 6,000 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
- L<sup>A</sup>T<sub>E</sub>X

- **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

- **Robotics Skills**

- Machine Learning

- \* Deep Learning
- \* Artificial Neural Networks
- \* Recurrent Neural Networks
- \* Embedded Machine Learning
- \* Reinforcement Learning
- \* Heuristic Optimization
- \* Convex Optimization
- \* Image Processing

- Control Systems

- \* Optimal Control
- \* Automatic Control
- \* Robust Control

- Game Theory

- \* Differential Game
- \* Multi-Agent Systems
- \* Cooperative Game
- \* Non-Cooperative Game

- **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)



- **Robotics:**

*Provided by University of Pennsylvania, Coursera*

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- Aerial Robotics
- Computational Motion Planning
- Mobility
- Perception
- Estimation and Learning
- Capstone

- **Reinforcement Learning:**

*Provided by University of Alberta, Coursera*

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- 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*

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- **Python Data Structures:**

*Provided by University of Michigan, Coursera*

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- **Introduction to Embedded Machine Learning:**

*Provided by Edge Impulse, Coursera*

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- **Game Theory:**

*Provided by Stanford University, Coursera*

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## 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](#)
-  [ar.sharifi@sharif.edu](mailto:ar.sharifi@sharif.edu)
-  [Google Scholar Profile](#)
-  (+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](#)
-  [nobahari@sharif.edu](mailto:nobahari@sharif.edu)
-  [Google Scholar Profile](#)
-  (+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](#)
-  [banazadeh@sharif.edu](mailto:banazadeh@sharif.edu)
-  [Google Scholar Profile](#)
-  (+98)-21-6616-8108