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**
  - **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

- 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 **Reinforcement Learning** methods, comparing their performance with classical strategies, such as **model predictive control (MPC)**, to identify strengths and weaknesses.
- Integrated **ROS** to test and validate robotic systems in **real-world** scenarios.
- Utilized **differential game theory** to develop **robust** and **safe** 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 Aircraft] Tehran, Iran
Supervisors: Afshin Banazadeh, PhD
Top Group Project for Two Semesters

- 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

- **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

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
  - 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
- **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)

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