STATEMENT OF PURPOSE

Reza Pordal, Ph.D. Candidate, r.pordal@yahoo.com

RESEARCH INTEREST

A fundamental question has driven me throughout my academic journey: How can we improve **human safety**? As a researcher specializing in control theory, I am particularly focused on developing robustly safe controllers for safety-critical systems.

BACKGROUND

During my undergraduate study, my research was focused on designing a robust controller to counteract **external disturbances**. The main challenge we faced was dealing with an intelligent disturbance that used the system's dynamic model to amplify errors with minimum effort. To address this, we modeled the control problem as a **zero-sum game** between the controller and disturbance and found the controller policy that minimized disturbance impact. This project earned me the Iranian **Best B.S. Thesis** Award of 2022, and a paper was published in the **ISA Transactions** journal.

Currently, I am designing **safety filters for uncertain systems** at the Control and Navigation of Autonomous Vehicles Lab. Safety filters offer a modular approach to the safety problem, allowing for a variety of controllers while maintaining system safety guarantees. A key challenge in this work is addressing model uncertainties in formal safety guarantees, as the safety filters I'm developing are model-based.

FUTURE RESEARCH GOALS

In the future, I aim to explore a comprehensive approach to robust safety known as the **Hamilton-Jacobi-Isaacs reachability analysis**, grounded in optimal control and game theory. While this method is computationally expensive, especially for high-dimensional systems, I intend to simplify it using specific assumptions, such as linear models, to reduce computational costs or even find analytical solutions. However, this approach may result in conservative safety actions. To address this, combining reachability analysis with other safety control approaches, like **predictive safety** methods, could be an effective way to develop an efficient and safe control scheme. Moreover, as safety controller approaches are a relatively new topic, **their application in safety-critical systems**, particularly surgical robotics, remains an exciting area for exploration and innovation.

CAREER ASPIRATIONS

Beyond my research experiences, I have served as a teaching assistant for over four years and have mentored multiple undergraduate and master's students in their thesis work, finding these roles incredibly fulfilling. These experiences have led me to conclude that **pursuing a career in academia** as a faculty member would be an excellent choice for my future. My passion for both research and education, coupled with the satisfaction I derive from guiding students, has solidified my desire to contribute to the academic community.

WHY UOTTAWA?

The Ph.D. position at uOttawa research goal aligns closely with my future research aspirations and background. Moreover, the opportunity to collaborate with world-class supervisors and researchers makes this position ideal for any researcher.

REZA PORDAL

r.pordal@yahoo.com
Linkedin
Google Scholar

Reza Pordal recently graduated with an M.Sc. in Aerospace Engineering from the Sharif University of Technology in Iran. His main research interest is in **autonomous systems**, with a particular focus on addressing **environmental challenges** and developing **safe** and **robust** control systems.

EDUCATION

M.Sc. Aerospace Engineering, Flight Dynamics and Control — October 2021 – February 2024
Sharif University of Technolgy, Department of Aerospace Engineering – *Iran*
GPA: 16.89/20 ~ 3.65/4

B.Sc. Aerospace Engineering — October 2016 – May 2021
Sharif University of Technolgy, Department of Aerospace Engineering – *Iran*
GPA: 16/20 ~ 3.27/4

High School — September 2014 – May 2016
National Organization for Development of Exceptional Talents School – *Iran*
GPA: 19.98/20 ~ 4/4

PUBLICATIONS

1. H. Nobahari, **R. Pordal**, "Pitch Control of a Quadrotor using A Linear Quadratic Regulator with Integral Action based on the Differential Game Theory." *20th International Conference on Iranian Aerospace* (2022).
2. A. BaniAsad, **R. Pordal**, A. Sharifi, and H. Nobahari. "Attitude control of a 3-DoF quadrotor platform using a linear quadratic integral differential game approach." *ISA transactions* (2024).
3. **R. Pordal**, A. Banazadeh, "An Enhanced Path-Planning Framework for Heterogeneous UAV Teams Employing Self-Organizing Map Neural Networks." *Unmanned Systems* (Under Review)
4. **R. Pordal**, A. Sharifi, "A Linear Quadratic Differential Game Safety Filter for Nonlinear Dynamic Systems in the Presence of Disturbance" (In Progress)

PROJECTS

Autonomous Multi-UAV Search of Forests for Early Wildfire Detection — January 2023 – September 2023
M.S. Thesis, Sharif University of Technology
- Score: P_EX (4/4)
- Heterogeneous multi-UAV path planning in large-scale environments for maximizing wildfire detection likelihood using heuristic optimization methods and artificial neural networks.

Robust Attitude and Position Control of a Quadcopter in the Presence of Wind Disturbance and Discontinuous GPS Signal Reception — January 2022
Final course project for Advanced Automatic Control, Sharif University of Technology
- Score: 4/4
- Designed and simulated a robust linear feedback controller along with kinetic and kinematic-based Kalman filter

Control of a Single Axis Attitude of a Quadcopter Using a Linear Quadratic Integral Regulator Based on the Differential Game Theory — January 2021 - September 2021
B.Sc. Thesis, Sharif University of Technology
- Score: 4/4
- a linear quadratic integral regulator based on the differential game theory was proposed and implemented using a model-based design method on a single-degree-of-freedom attitude control system.

Attitude Control of a CubeSat Using Linear Quadratic Gaussian (LQG) Controller — May 2021 - September 2021
Internship, Control Systems Lab, Sharif University of Technology
- Score: P_EX (4/4)
- Designed, implemented, and tested an LQG controller on a CubeSat (Cubli)

HONORS

1. Ranked among the **top 2%** out of more than 150,000 applicants, Nation-wide University Entrance Exam, Iran (2016)
2. Achieved a **rank of 9** out of a total of one thousand participants in the master's entrance exam (2021).
3. **Iranian Best B.Sc. Thesis Award**, Awarded by the Iranian Aerospace Society (2022).

EXPERIENCES

Research Assistant | CNAV Lab, Department of Aerospace Engineering, Sharif University of Technology   **Spring & Fall 2023**
- Research in multi-robot path planning
- Research in aerial robot model-aided navigation
- Supervised undergraduate students

Teaching Assistant | Graduate Integrated Navigation Course: **Fall 2023**
- Guided graduate students in their course projects
- Assisted students in preparing and delivering presentations on the course topics
- Supported the professor in developing course materials and assessments.
- Provided technical guidance to graduate students to ensure successful hardware-based implementations of their projects.

Head Teaching Assistant | Undergraduate Control Theory, Control Systems Lab, and Introduction to Aerospace Engineering Course: **Spring 2023**
- Contributed to the improvement of teaching methodologies.
- Continued to mentor and guide students in their academic journeys.

Head Teaching Assistant | Undergraduate Control Theory and Control Systems Lab Course: **Spring & Fall 2022**
- Led a team of TAs
- Collaborated with faculty to enhance the course curriculum.
- Organized and conducted office hours to provide additional support to students.

Head Teaching Assistant | Undergraduate Dynamic Course: **Fall 2021**
- Led a team of TAs
- Worked with faculty to design and evaluate exams and assignments.

Teaching Assistant | Undergraduate Control Theory and Control Systems Lab Course: **Spring 2021**
- Collaborated with professors to develop and improve course materials.
- Assisted in conducting lab sessions, guiding students on practical aspects of control systems.
- Conducted review sessions to help students comprehend challenging topics.
- Designed and organized a control-based competition for students

Teaching Assistant | Undergraduate Control Systems Lab Course: **Fall 2020**
- Graded assignments and lab reports

SKILLS

Language Proficiency level:
IELTS Overall Score: 7.5: Reading: 8.5, Listening: 8.5, Writing:7, Speaking:6.5

Programming Languages and Software:
Matlab & Simulink, Python, Arduino, ROS 1.

REFERENCES

1. **Dr. Alireza Sharifi**
   Assistant Professor of Aerospace Engineering Sharif University of Technology– *Tehran, Iran*
   Email: ar.sharifi@sharif.edu
   Website: http://ae.sharif.edu/~portal/faculty/1730782165
   Note: I worked as Dr. Alireza Sharifi's teaching assistant for more than three years and research assistant for one year.
2. **Dr. Hadi Nobahari**
   Professor of Aerospace Engineering Sharif University of Technology– *Tehran, Iran*
   Email: nobahari@sharif.edu
   Website: http://ae.sharif.edu/~portal/faculty/1091235256
   Note: Dr. Nobahari supervised my undergraduate thesis.
3. **Dr. Afshin Banazadeh**
   Professor of Aerospace Engineering Sharif University of Technology– *Tehran, Iran*
   Email: banazadeh@sharif.edu
   Website: http://ae.sharif.edu/~portal/faculty/1014037799
   Note: I was supervised by Dr. Afshin Banazadeh for my master's thesis.

SHARIF UNIVERSITY OF TECHNOLOGY
UNOFFICIAL TRANSCRIPT

NAME: REZA PORDAL
STUDENT ID: 400211813
NATIONAL CODE: 4260281331

DEGREE: M.Sc.
DEPARTMENT: AEROSPACE ENG.
PROGRAM: AEROSPACE ENGINEERING/ DYNAMICS & CONTROL

COURSE NO	COURSE TITLE	UNIT	GRADE
FALL SEM 2021-2022 (ONLINE)			
45-705	ADV FLIGHT DYNAMICS 1	3	13.2
45-710	ADV AUTOMATIC CONTROL	3	16.7
	SEMESTER UNITS, AVERAGE	6	14.95
	TOTAL UNITS GAINED, CUM AV	6	14.95
SPRING SEM 2021-2022			
45-510	ADV MATH 1	3	19.2
45-715	NAVIGATION & GUIDANCE 1	3	17.2
45-747	MODELING AEROSPACE DYN SYS	3	14.9
	SEMESTER UNITS, AVERAGE	9	17.10
	TOTAL UNITS GAINED, CUM AV	15	16.24
FALL SEM 2022-2023			
25-549	FUZZY SYS	3	16.0
45-600	MSC SEMINAR	2	19.0
45-736	ADV CONCEPTS A/C DSGN	3	16.5
45-766	OPTIMAL CONTROL 2	3	W
	SEMESTER UNITS, AVERAGE	8	16.94
	TOTAL UNITS GAINED, CUM AV	23	16.48
SPRING SEM 2022-2023			
25-443	NEURAL NETWORKS	3	20.0
45-560	MSC THESIS	6	S
	SEMESTER UNITS, AVERAGE	9	20.00
	TOTAL UNITS GAINED, CUM AV	32	16.89

COURSE NO	COURSE TITLE	UNIT	GRADE
FALL SEM 2023-2024			
45-560	MSC THESIS	0	P_EX
	SEMESTER UNITS, AVERAGE	--	--
	TOTAL UNITS GAINED, CUM AV	32	16.89

NO ENTRY BELOW THIS LINE

Abbr.	W: Withdraw	P_EX: Excellent	P_GO: Good
	S: Satisfied	P_VG: Very Good	P_FA: Fair

NOTES:
1. Numerical Grades Range from 0 to 20. Passing Grade is 12.
2. Average Department and University GPAs for this Class of Students are 15.83 and 16.49, Respectively.
3. Online Semesters are Due to COVID-19 Pandemic.

Auth Code
Expires: 04-2025

SHARIF UNIVERSITY OF TECHNOLOGY
UNOFFICIAL TRANSCRIPT

NAME: REZA PORDAL
STUDENT ID: 95110054
NATIONAL CODE: 4260281331
TRANSFERRED FROM SHIRAZ UNIVERSITY

DEGREE: B.Sc.
DEPARTMENT: AEROSPACE ENG.
PROGRAM: AEROSPACE ENGINEERING

COURSE NO	COURSE TITLE	UNIT	GRADE
CREDITS TRANSFERRED FROM SHIRAZ UNIVERSITY			
23-011	GEN CHEM 1	3	CR
24-011	PHYSICS 1	3	CR
31-119	INTRO PERSIAN LITERATURE	3	CR
35-311	ENG GRAPHICS 1	2	CR
37-127	LIFE STYLE	2	CR
	SEMESTER UNITS, AVERAGE	13	--
	TOTAL UNITS GAINED, CUM AV	13	--

ADMITTED TO SUT, ID. NO. 95110054

COURSE NO	COURSE TITLE	UNIT	GRADE
SPRING SEM 2016-2017			
22-016	GEN MATH 2	4	14.1
24-002	PHYSICS LAB 2	1	16.5
24-012	PHYSICS 2	3	15.0
30-003	PHYSICAL EDUCATION	1	19.7
31-123	FOREIGN LANG	3	18.0
40-153	INTRO PROGRAMMING	3	20.0
45-112	STATICS	3	16.1
	SEMESTER UNITS, AVERAGE	18	16.66
	TOTAL UNITS GAINED, CUM AV	31	16.66
FALL SEM 2017-2018			
22-034	DIFF EQN	3	12.8
22-063	ENG PROB & STAT	3	18.5
45-113	DYNAMICS	4	15.7
45-119	NUMERICAL METHODS	2	W
45-124	FLUID MECHANICS 1	3	17.5
45-134	THERMODYNAMICS 1	3	13.7

COURSE NO	COURSE TITLE	UNIT	GRADE
FALL SEM 2017-2018 (CONT.)			
	SEMESTER UNITS, AVERAGE	16	15.64
	TOTAL UNITS GAINED, CUM AV	47	16.18
SPRING SEM 2017-2018			
25-091	FUND ELEC ENG 1	3	16.2
37-490	NAHJOL BALA GHEH SUBJ INTERPRET	2	14.5
45-030	AER ROBOT WORKSHOP 1	1	17.0
45-115	AERODYNAMICS 1	3	14.3
45-132	INTRO TO AEROSPACE	2	16.8
45-144	VIBRATIONS	3	9.5
45-407	ORBITAL MECHANICS	3	14.0
	SEMESTER UNITS, AVERAGE	17	14.21
	TOTAL UNITS GAINED, CUM AV	61	15.53
SUMMER 2017-2018			
45-070	ENGINE WORKSHOP 1	1	18.0
	SEMESTER UNITS, AVERAGE	1	18.00
	TOTAL UNITS GAINED, CUM AV	62	15.57
FALL SEM 2018-2019			
22-035	ENG MATH	3	14.4
33-018	GENERAL WORKSHOP	1	16.9
37-445	ISLAMIC THOUGHT 1	2	18.5
45-116	AERODYNAMICS 2	3	17.3
45-119	NUMERICAL METHODS	2	20.0
45-125	THERMODYNAMICS 2	3	17.1
45-133	STRENGTH OF MATERIALS	3	18.1

Abbr.	W: Withdraw	CR: Credit Received	P_EX: Excellent	P_GO: Good
	P: Pass	NC: Project Complete/No Credit	P_VG: Very Good	P_FA: Fair

NOTES:
1. Numerical Grades Range from 0 to 20. Passing Grade is 10.
2. Average Department and University GPAs for this Class of Students are 14.59 and 15.71, Respectively.
3. Online Semesters are Due to COVID-19 Pandemic.

Auth Code
Expires: 12-2024

SHARIF UNIVERSITY OF TECHNOLOGY
UNOFFICIAL TRANSCRIPT

NAME: REZA PORDAL
STUDENT ID: 95110054
NATIONAL CODE: 4260281331
TRANSFERRED FROM SHIRAZ UNIVERSITY

DEGREE: B.Sc.
DEPARTMENT: AEROSPACE ENG.
PROGRAM: AEROSPACE ENGINEERING

COURSE NO	COURSE TITLE	UNIT	GRADE
FALL SEM 2018-2019 (CONT.)			
	SEMESTER UNITS, AVERAGE	17	17.33
	TOTAL UNITS GAINED, CUM AV	79	16.01
SPRING SEM 2018-2019			
30-004	SPORT 1	1	17.0
37-446	ISLAMIC THOUGHT 2	2	20.0
45-117	PROPULSION PRIN	3	16.7
45-126	HEAT TRANSFER 1	3	15.0
45-144	VIBRATIONS	3	15.9
45-406	INTRO TO CFD	3	15.9
	SEMESTER UNITS, AVERAGE	15	16.50
	TOTAL UNITS GAINED, CUM AV	94	16.09
SUMMER 2018-2019			
45-041	STRUCTURE LAB	1	11.5
45-050	AERODYNAMICS LAB 1	1	16.5
	SEMESTER UNITS, AVERAGE	2	14.00
	TOTAL UNITS GAINED, CUM AV	96	16.05
FALL SEM 2019-2020			
37-620	ANAL HIST OF INITIAL ISLAM	2	17.0
45-071	ENGINE WORKSHOP 2	1	19.5
45-135	AUTOMATIC CONTROL	3	17.7
45-136	A/C STRUCTURAL ANALYSIS	3	15.0
45-156	FLIGHT DYNAMICS 1	3	13.5
45-418	INTRO FINITE ELEMENT METD	3	13.5
	SEMESTER UNITS, AVERAGE	15	15.51
	TOTAL UNITS GAINED, CUM AV	111	15.97
SPRING SEM 2019-2020 (ONLINE)			
22-015	GEN MATH 1	4	W
24-001	PHYSICS LAB 1	1	15.4
37-626	ISLAMIC REVOLUTION OF IRAN	2	19.5
45-137	A/C STRUCTURAL DSGN	3	15.0
45-415	MATERIALS & CONSTR METDS	3	W
45-422	PILOT TRAINING	2	15.0

COURSE NO	COURSE TITLE	UNIT	GRADE
SPRING SEM 2019-2020 (ONLINE) (CONT.)			
45-425	INTRO MISSILE DESIGN	3	15.2
	SEMESTER UNITS, AVERAGE	11	15.91
	TOTAL UNITS GAINED, CUM AV	122	15.96
SUMMER 2019-2020 (ONLINE)			
45-085	CONTROL SYSTEM LABORATORY	1	20.0
	SEMESTER UNITS, AVERAGE	1	20.00
	TOTAL UNITS GAINED, CUM AV	123	16.00
FALL SEM 2020-2021 (ONLINE)			
22-015	GEN MATH 1	4	16.3
37-514	THE KNOWLEDGE OF FAMILY & POPULATION	0	P
45-157	FLIGHT DYNAMICS 2	3	13.1
45-177	AIRCRAFT DESIGN 1	3	17.1
45-415	MATERIALS & CONSTR METDS	3	15.4
	SEMESTER UNITS, AVERAGE	13	15.54
	TOTAL UNITS GAINED, CUM AV	136	15.95
SPRING SEM 2020-2021 (ONLINE)			
28-702	THERMODYN LAB	1	11.0
45-500	BSC PROJECT	3	20.0
	SEMESTER UNITS, AVERAGE	4	17.75
	TOTAL UNITS GAINED, CUM AV	140	16.00
SUMMER 2020-2021 (ONLINE)			
45-400	INDUSTRIAL TRAINING	0	P_EX
45-500	BSC PROJECT	0	NC
	SEMESTER UNITS, AVERAGE	--	--
	TOTAL UNITS GAINED, CUM AV	140	16.00

COMPLETED REQ FOR B.Sc. DEGREE ON 22-9-2021

NO ENTRY BELOW THIS LINE

FOR ABBREVIATIONS REFER TO THE FIRST PAGE