

Amir H. Khodabakhsh

Experienced Researcher Specializing in
Deep Learning and Stochastic Nonlinear Dynamics

EDUCATION

Sharif University of Technology

Ph.D., Flight Dynamics and Control (2017 - 2023)

Thesis: Development of a Smart Learning-Based Distributed Load Alleviation System for Future Generation of Aeroelastic Wings

Sharif University of Technology

M.Sc., Flight Dynamics and Control (2014 - 2016)

Thesis: Reliability-Based Multidisciplinary Design Optimization of an Aeroelastic Projectile

K. N. Toosi University of Technology

B.Sc., Aerospace Engineering (2009 - 2014)

Thesis: Design and Implementation of a Hardware-In-the-Loop Testbed for An Attitude Control System

Skills

Programming languages

- ✓ Expert: MATLAB, Python, C/C++, Julia, JavaScript
- ✓ Proficient: Rust, Fortran, Visual Basic.

Deep Learning

- ✓ TensorFlow, PyTorch, JAX
- ✓ Bayesian Deep Learning
- ✓ Physics-Informed NNs(PINNs)
- ✓ Uncertainty Quantification

Computer Science

- ✓ High-Performance Computing
- ✓ Numerical Methods and Optimization
- ✓ Parallel & Distributed Comp.

Mathematics

- ✓ Nonlinear Dynamics & Control
- ✓ Differential Equations & Numerical Analysis
- ✓ Probability & Statistics

Other Selected Professional Software Packages:

- ✓ Expert: MATLAB/SIMULINK, Maple, LabView, SolidWorks, ABAQUS, ANSYS, Fluent
- ✓ Proficient: CATIA, Mathematica, AutoCAD

Contact

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👤 Amir H. Khodabakhsh

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Research Interests

- ✓ Nonlinear Stochastic Dynamics Analysis and Control
- ✓ Deep Learning and Artificial Intelligence
- ✓ Reinforcement Learning
- ✓ Multidisciplinary Design Optimization (MDO)
- ✓ Robotics and Autonomous Systems
- ✓ Nonlinear Model Predictive Control (NMPC)

About Me

Driven and passionate researcher with expertise in nonlinear stochastic dynamics, deep learning, and aero-servo-elasticity. Proven track record of developing innovative solutions in control, estimation, and multidisciplinary design optimization (MDO). Dedicated to contributing to the scientific

community through research, teaching, and collaboration.

Selected Personal Soft Skills

- ✓ Teamwork
- ✓ Innovative Solution Provider
- ✓ Curious and persistent
- ✓ Self-driven

Selected Professional Skills

- ✓ Complex Systems Engineering
- ✓ Process & Design Optimization

Selected Developed Software

- ✓ **FPK-DP Net Framework**
Physics-informed deep learning framework for nonlinear dynamics analysis and control
 - Python & C++
 - FPK Solver
 - Physics-Informed DNN
- ✓ **DeepPDEM Framework**
Probabilistic data-driven estimation framework for uncertain systems.
 - Python & C++
 - PDEM Solver
 - Physics-Informed DNN
- ✓ **DynNet Framework**
Physics-informed neural network framework for control and optimization.
 - Python & C++
 - PINN
 - Nonlinear ODE Solver

Journal Publications

Khodabakhsh, A.H. and Pourtakdoust, S.H., 2024. Solution of FPK equation for stochastic dynamics subjected to additive Gaussian noise via deep learning approach. *Structural Safety*, 106, p.102399.

DOI: [j.strusafe.2023.102399](https://doi.org/10.1016/j.strusafe.2023.102399)

Pourtakdoust, S. H. and **Khodabakhsh, A. H.**, 2022. A deep learning approach for the solution of probability density evolution of stochastic systems. *Structural Safety*, 99, p.102256.

DOI: [10.1016/j.strusafe.2022.102256](https://doi.org/10.1016/j.strusafe.2022.102256)

Pourtakdoust, S.H. and **Khodabakhsh, A.H.**, 2023. Reliability-based multidisciplinary design optimization of an aeroelastic unpowered guided aerial vehicle. *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*, p.09544100231198160.

DOI: [10.1177/09544100231198160](https://doi.org/10.1177/09544100231198160)

Pourtakdoust, S. H. and **Khodabakhsh, A. H.**, 2023. Modeling and Simulation of Nonlinear Dynamics Using Physics-Informed Deep Neural Networks. *Technology in Aerospace Engineering*, 6(4), pp.25-36.

DOI: [10.30699/jtae.6.4.3](https://doi.org/10.30699/jtae.6.4.3)

Khodabakhsh, A. H., Pourtakdoust, S. H., 2024. A Deep Learning Approach to Model Predictive Gust Load Alleviation for A Compliant Wing Subjected to Atmospheric Turbulence, *Journal of Guidance, Control, and Dynamics*

[Under Review]

Conference Papers

Khodabakhsh, A.H. and Pourtakdoust, S.H.(2020) Aeroelastic wing vibration control using smart materials and changes in equivalent structural properties, ICIAS 2020

Khodabakhsh, A.H. and Pourtakdoust, S.H.(2021) Nonlinear dynamic modeling using physics-informed deep neural networks, ICIAS 2021

Mohammadzadeh, K., Pourtakdoust, S.H., and **Khodabakhsh, A.H.** (2022) Design and construction of aeroelastic wing load reduction control system with smart material approach, ICIAS 2022

Selected Research Experience

Research Assistant, Sharif University of Technology, 2014-2024

- ✓ Conceptualized and designed the "smart wing" for gust load alleviation using PINNs
- ✓ Developed a software framework for MDO with focus on aircraft reliability using parallel computing
- ✓ Implemented scheduling and control of a Stewart platform motion

Research Assistant, Space Systems Design Institute, 2012-2014

- ✓ Developed Model-In-the Loop (MIL), Software-In-the Loop (SIL), Processor-In-the Loop (PIL) and Hardware-In-the Loop (HIL) simulator and for satellite attitude control
- ✓ Optimized the design and implemented a sub-scale supersonic wind tunnel

Teaching Experience

Teaching Assistant, Flight Tests, SUT, 2021

Teaching Assistant, Flight Dynamics, SUT, 2017-2020

Instructor, MATLAB Introductory Course, HEDSA, 2015

Instructor, C# Coding of Engineering Concepts, HEDSA, 2015

Instructor, Intro. to LabView control loop implementation, SSDI 2015

Instructor, MATLAB and SIMULINK, SSDI 2014

Teaching Assistant, Automatic Control, KNTU, 2013

Instructor, MATLAB Introductory Course, KNTU, 2011

Instructor, Zodiac Mythology, a workshop held in Fajr High school, 2010

Instructor, Astronomy Introductory Course, Fajr High school, 2009

- ✓ **UVLM Solver (Multiple Implementations)**
 - C++/MATLAB/Julia
- ✓ **Nonlinear Aircraft Stability Analyzer & Control Designer**
 - MATLAB
- ✓ **Aero-Servo-Elastic Systems Stability Analyzer**
 - Julia
- ✓ **Auto Code-Generation Toolset for Zephyr OS**
 - MATLAB/Simulink & C/C++
 - Multi-Tasking
 - ROS
- ✓ **FlyDyn**
 - Nonlinear Advanced Flight Simulator
 - C/C++, C#

Languages

- ✓ English (Fluent)
- ✓ Persian (Fluent)
- ✓ French (Basic)
- ✓ Spanish (Basic)

Interests

- ✓ Advanced Scientific Computing
- ✓ Software Development
- ✓ Reading