

ROOHOLLA KHORRAMBAKHT

r.khorrambakht@gmail.com | (+98) 917 475 8203 | www.linkedin.com/in/r-khorrambakht | rooholla-kho.github.io

EDUCATION

K.N.Toosi University of Technology

Master of Mechatronics Engineering; First-Rank Student with a GPA of 4 (18.36/20)

Tehran, Iran

Sep. 2016 to Feb. 2020

Hormozgan University

Bachelor of Electronics Engineering; First-Rank Student with a GPA of 4 (18.24/20)

Bandar Abbas, Iran

Sep. 2012 to Aug. 2016

RESEARCH INTERESTS

- Hybrid Model-Based and Learned Control and Perception Systems
- Spatial Knowledge Graphs for Perception and Control
- Certifiability and Safety of Learned Control and Perception
- Multi-View Representation Learning

RESEARCH EXPERIENCE

Smart Electric Bicycle

Embedded Systems Engineer and Research Assistant

University of Tehran

June. 2020 to Now

- Collaborated in a team of two to design and fabricate the embedded computing and sensory systems of an electric bicycle.
- Developed a hybrid python and C++ software stack for enabling swift data collection and deployment of learning algorithms on the vehicle.

Perception for Safe Driver Assistance

Researcher

ARAS Autonomous Robotics Lab

April. 2020 to Now

- Collaborated in a team of two to create learning-based modules for ego-motion estimation based on cameras installed on cars with driver-assistance systems.
- Recorded a dataset containing the visual, motion, and kinematic sensors of a cable-driven robot for movie industries.

Multi-Modal Calibration and control of ARAS Cable-Driven Parallel Robot

Researcher (M.Sc. Thesis)

ARAS Parallel Robotics Lab

Sep. 2016 to Feb. 2020

- Developed a graph-based probabilistic state estimation system to combine kinematics and vision sensors on the ARAS-CAM robot to control and calibrate it.
- Designed, implemented, and calibrated an end-effector with onboard motion and vision sensors, and a mini-computer to record and process their data.
- Designed and implemented the decentralized electronics system of the ARAS-CAM robot with sub-milliseconds latency and high sampling rate.
- Designed and implemented a multi-view measurement system for the ARAS-Labs that is used as a millimeter-level ground-truth measurement device for the ARAS-CAM cable robot.

Design and Implementation of an Educational Quadrotor

Internship

Hormozgan University Robotics Lab

Sep. 2014 to Aug. 2016

- Designed and built an inexpensive 3D-printed quadrotor with custom electronics for application in the advanced control course.
- Developed the algorithms for orientation estimation and stabilization of the robot.

Design, Implementation, and control of an Inverted Pendulum System

Researcher (B.Sc. Thesis)

Hormozgan University Robotics Lab

Sep. 2014 to Aug. 2016

- Designed and built a 3D-printed inverted pendulum system for advanced control education.
- Designed and implemented a motor driver with analog current feedback for the DC actuator of the robot.
- Parameter identification and control of the platform

SELECTED PUBLICATIONS

Conference Papers

- R. Khorrambakht, H. Damirchi, H. D. Taghirad; "Preintegrated IMU Features For Efficient Deep Inertial Odometry" [Link]

This paper exploits the preintegration theory to propose a novel and efficient representation of motion measurement data for efficient ego-motion estimation. Furthermore, this work demonstrates the efficiency of the method through its implementation on a resource-constrained microcontroller.

- H. Damirchi, R. Khorrambakht, and H. D. Taghirad; "Exploring Self-Attention for Visual Odometry." [Link].

This work investigates the importance of self-attention in learning high-quality and interpretable features for visual ego-motion estimation. The findings of the paper show that with self-attention, the model learns representations that disregard ego-motion unrelated objects and lead to superior odometry performance compared to the state-of-the-art.

- H. Damirchi, R. Khorrambakht, and H. D. Taghirad; "ARC-Net: Activity Recognition Through Capsules.", IEEE International Conference on Machine Learning and Applications(ICMLA), 2020. [Link]

This paper exploits the part-to-whole presentation power of capsule neural nets in a multi-modal human activity recognition setting based on combined motion data from devices on the body.

- **R. Khorrambakht**, H. Damirchi, S. A. Kalilpour, and H. D. Taghirad; “**A Calibration Framework for Deployable Cable-Driven Parallel Robots with Flexible Cables**,” International Conference on Robotics and Mechatronics IcRoM, 2019. [\[Link\]](#)

This paper proposes a self-calibration algorithm and embedded measurement device for facilitating easy and fast installation of suspended cable-driven robots at new sites.

- H. Damirchi, **R. Khorrambakht**, H. D. Taghirad; “**ARAS-IREF : An Open-Source Low-Cost Framework for Pose Estimation**,” International Conference on Robotics and Mechatronics IcRoM, 2019. [\[Link\]](#)

This paper presents an accurate ground-truth measurement device for application in high accuracy eye surgery manipulators.

Journal Papers

- H. Damirchi, **R. Khorrambakht**, H. D. Taghirad, and Behzad Moshiri; “**A Consistency-Based Loss for Deep Odometry Through Uncertainty Propagation**” IEEE Robotics and Automation Letters (RA-L) (Under Review) [\[Link\]](#)

This paper exploits the Lie theory to define PDFs over SE(3) manifolds. Then, A maximum likelihood formulation is adopted to teach the model about the aleatoric uncertainty. Finally, a balance between the long and short-term odometry losses has been defined through the propagation of this uncertainty.

- A. Bataleblu a, **R. Khorrambakht**, H. D. Taghirad; **Robust H Infinity Based Control of ARAS-Diamond: A Vitrectomy Eye Surgery Robot** Journal of Mechanical Engineering Science 2020 [\[Link\]](#)

This paper proposes a robust H-infinity linear controller for a parallel spherical manipulator for eye surgery. Partial feedback linearization through gravity compensation by a black-box neural network transforms the plant into a quasi-linear system for which an H-infinity controller may be applied.

- S. A. Khalilpour, **R. Khorrambakht**, H. Damirchi, H. D. Taghirad, P. Cardou; “**Tip-trajectory tracking control of a deployable cable-driven robot via output redefinition**.” Multibody System Dynamics 2020 [\[Link\]](#)

This paper proposes a novel feedback method for fusing the vision and joint kinematic sensors for achieving suitable tracking performance in robots with kinematic uncertainties.

- S. A. Khalilpour, **R. Khorrambakht**, H. D. Taghirad, and P. Cardou; “**Robust cascade control of a deployable cable-driven robot**” Mechanical Systems and Signal Processing 2019. [\[Link\]](#)

This paper investigates the dynamic formulation and control of a deployable cable-driven robot with structural uncertainties. The outcome of this paper is a cascade controller with proven stability that facilitates the easy applicability of the robot in movie industries.

SKILLS

Language

- **Farsi:** Native
- **English:** TOEFL IBT: 111/120 (Reading: 29/30, Listening: 29/30, Writing: 27/30, Speaking: 26/30)

Programming

- **Languages:** Python, C/C++, High Level Synthesis
- **AI Platforms:** Pytorch, Vitis AI, Tiny-ML
- **Frameworks:** ROS, GTSAM

Embedded Platforms

- **Platforms:** Zynq UltraScale MPSoC, ARM STM32 Cortex Microcontrollers
- **Embedded Linux:** PetaLinux, Buildroot
- **Developer Tools:** Git, Docker

CAD/CAM

- **Software:** Solidworks, Adams Multibody Dynamics, Altium Designer
- **3D Printing:** Design and implementation of a custom FDM 3D printer for the ARAS PACR Lab.
- **CAM:** Design and implementation of CNC Router for the ARAS PACR Lab.

HONORS

First-Rank Student

Graduation with the highest GPA.

First-Rank Student

Graduation with the highest GPA.

K.N.Toosi University of Technology

Feb. 2020

Hormozgan University

Aug. 2016

SELECTED COURSES

- **Parallel Robots**
(By Prof. Taghirad at K.N.Toosi)
- **Data Fusion Methods**
(By Prof. Moshiri at Tehran University)
- **System Identification**
(By Prof. Aliyari at K.N.Toosi)
- **Nonlinear Control Systems**
(By Prof. Taghirad at K.N.Toosi)
- **Deep Learning Specialization [Link]**
(A Specilization Instructed by Prof. Andrew Ng on Coursera)
- **Introduction to Self-Driving Cars [Link]**
(By Prof. Steven Waslander on Coursera)
- **State Estimation and Localization for Self-Driving Cars [Link]**
(By Prof. Jonathan Kelly on Coursera)

REFERENCES

Hamid D. Taghirad

Professor, Faculty of Electrical Engineering, Vice-Chancellor for Global Strategies and International Affairs, K.N.Toosi University of Technology.
(M.Sc. Supervisor)

Email: taghirad@kntu.ac.ir

Hamed Kebriaei

Associate Professor, School of Electrical and Computer Engineering, University of Tehran

Email: Kebriaei@ut.ac.ir

Abbas Harifi

Assistant Professor, Department of Electrical and Computer Engineering, University of Hormozgan.

(B.Sc. Supervisor)

Email: harifi@hormozgan.ac.ir