Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 | 49 | ThC.9

Localization of an indoor mobile robot using decentralized data fusion

Ali Zali[1], Mohammad Bozorg[1], Mehdi Tale Masouleh[2]
[1] *Department of Mechanical Engineering, Yazd University, Yazd, Iran*
[2] *School of Electrical and Computer Engineering, University of Tehran, Tehran, Iran*

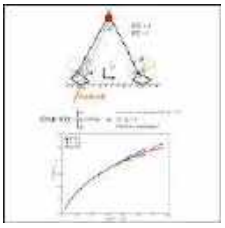
- In this study, a decentralized data fusion algorithm is used, where the sensors are used in several independent estimation loops.
- The estimates of local loops are exchanged to improve the accuracy of the position estimates.
- The sensors used in this study consist of a Laser Scanner, Kinect depth sensor, Encoder and IMU, which are divided into two local loops.
- The algorithm was implemented in a real environment on a robot built at the Mechatronics Laboratory of the Department of Mechanical Engineering, Yazd University.

14:30-16:30 | 85 | ThC.10

Stabilization of Unstable Limit Cycles in a Push-off Based Dynamic Walker by Reversible Switching Surfaces

Rana Danesh, Ali Tehrani Safa, Mahyar Naraghi
Mobile Robots Research Lab., Faculty of Mechanical Engineering, Amirkabir University of Technology, Tehran, Iran

- This study extends the concept of Reversible Switching Surfaces (RSS) to a push-off based dynamic walker with curved feet.
- The RSS controller improves the stability of dynamic walker by adjusting the angle of swing foot kinematically.
- The controller can successfully extend the range of stable motion by 80 percent.
- Results show that the dynamic biped can stably walk with longer step sizes at higher speeds.



14:30-16:30 | 95 | ThC.11

Robot localization performance using different SLAM approaches in a homogeneous indoor environment

Navid Zarrabi[1], Rasul Fesharakifard[1], Mohammad Bagher Menhaj[2]
[1] *New Technologies Research Center (NTRC), Faculty of Mechanical Engineering,Amirkabir University of Technology, Tehran, Iran*
[2] *Faculty of Electrical Engineering, Amirkabir University Technology, Tehran, Iran*

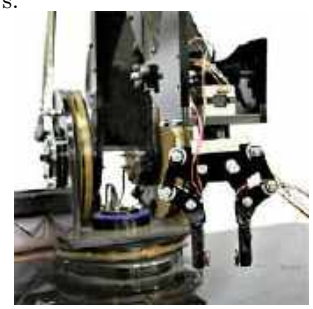
- In this work, Visual SLAM is implemented using Xbox 360 Kinect, Xbox One Kinect, Realsense D435 and Laser SLAM is implemented utilizing Hokuyo UTM30-LX.
- Benefits and drawbacks of using each are dicussed by referring to their performance.

14:30-16:30 | 105 | ThC.12

Design and Experimental Analysis of a Force Sensitive Gripper for Safe Robot Applications

Alireza Saboukhi[1,2], Masoud Rahimi Gorji[1,2], Ehsan Amirpour[1,2], Mohammad Savabi[1,2], Rasul Fesharakifard[2], Hamed Ghafarirad[2], S.Mehdi Rezaei[2]
[1] *New Technologies Research Center, Amirkabir University of Technology, Tehran, Iran*
[2] *Department of Mechanical Engineering, Amirkabir University of Technology, Tehran, Iran*

- This paper proposes design and implementation of a robotic 2-jaw gripper based on the optimization procedure to obtain haptic interaction with precise force feedback for an exoskeleton.
- This study also investigates a method to calibrate FSR sensors.



Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 106 ThC.13

Robust Real-time Lightweight Automatic License plate Recognition System for Iranian License Plates

Yusef Alborzi, Talaye Sarraf mehraban, Javad Khoramdel, Ali Najafi ardekany

Nasir Mechatronics Lab., Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran

- this paper proposes an Automatic License Plate Recognition (ALPR) system for unsupervised parking lot applications.
- to detect the plates in the image the Single Shot Detection architecture along with the MobileNet feature extractor was used.
- for optical character recognition, a lightweight convolutional neural network called LPRNet was used,
- finally, a large dataset of Iranian License plates was collected.

14:30-16:30 118 ThC.14

A novel gyroscopic stabilizer for a controlled unmanned bicycle

Mohammad Hanachi[1], Mohammad Mahjoob[1], Mohammad Ali Tofigh[1]

[1] *Center for mechatronocs and intelligent sysytems. School of Mechanical Engineering, University of Technology, Tehran, Iran*

- This study investigates the development of a novel gyrostabilizer which is capable of producing constant roll torque to stablize bicycles
- The dynamical model of the proposed device is extracted, and its benefits are discussed
- A gain-scheduled LQ tracker controller is designed to provide stability and trajectory tracking in a range of forward velocities
- Extensive numerical simulations based on real parameters of a bicycle, measured experimentaly, show the appropriate performance of the proposed scheme

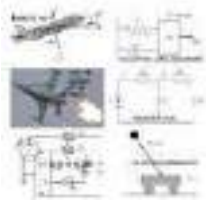
14:30-16:30 121 ThC.15

A Nonlinear Controller Based on the Convolutional Neural Networks

Hadi Nobahari, Yousef Seifouripour

Department of Aerospace Engineering, Sharif University of Technology, Tehran, Iran

- This paper focuses on developing a nonlinear controller based on the convolutional neural networks to control different plants.
- Prior knowledge about the plants is very limited and there are only sensory input-output data history of them.
- The trained controller is applied to six different linear and nonlinear plants, one of which is inherently unstable and different from the plants utilized in the training process.
- The simulation results show that the proposed controller can properly control all plants.



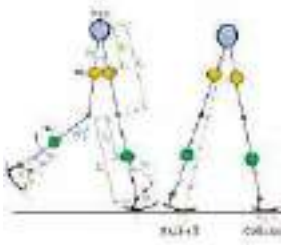
14:30-16:30 125 ThC.16

Semi-passive kneed walker: Analysis of foot parameters for an effective gait balance

Hosein Izi[1], Mahyar Naraghi[1], Ali Tehrani safa[1]

[1] *Mobile robot research Lab. Department of Mechanical Engineering, Amirkabir university of technology, Tehran, Iran*

- A human-like kneed push off based walker is considered in this study.
- This study analysis the effect of foot parameters on kneed walker for achieving improved velocity and stability performance.
- Simulation demonstrates a wide range of robot velocities for fixed energy input.



Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

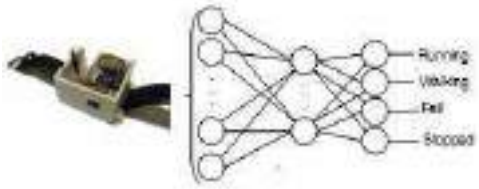
14:30-16:30 126 ThC.17

Sensory Feedback Performance Improvement on RoboCab

Amirreza Razmjoofard, Ali Sadighi, Mohammad Reza Zakerzadeh, Suorena Saeedi

School of Mechanical Engineering, University of Tehran, Tehran, Iran

- This research has investigated the possibility of detecting fall and Activities of Daily Living (ADLs) by the help of the three dominant frequencies of accelerations of wrist in each axis and their amplitudes.
- In this study, a wearable device is designed with an IMU to detect walking, running, staying still and falling.
- Results show 94.8% accuracy in detecting ongoing activity.
- Considering distinguishing fall from ADLs, the values for accuracy, sensitivity and specificity are 96%, 88% and 98%, respectively.



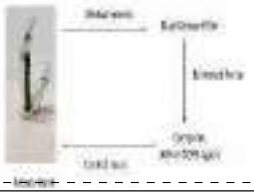
14:30-16:30 131 ThC.18

Robotic Hand Dual Force and State Estmiation and Control with Dual Kalman Filter and Deep Reinforcement Learning

Ahmad Reza Alghooneh[1], Amir-Hossein Yousefi-Koma[1], Ahmad Esmailzadeh[1]

[1] *Center of advanced Systems and Technologies (CAST). School of Mechanical Engineering, college of Engineering, University of Tehran Tehran, Iran*

- This study introduces a new method for force control in grasp problem, the proposed methods are much less costly in terms of sensory set-up.
- this becomes possible by optimal estimation of force with indirect measurement. On the control part, two approaches are taken,
- one is based on reinforcement learning and the other is a classic optimal controller (LQR).
- Consequently, Results approve the effieciency and accuracy of both schemes.



14:30-16:30 139 ThC.19

Deep Learning Approach For Object Tracking Of RoboEye

Ahmad Moori, Javad Khoramdel, S. Ali A. Moosavian

[1] *Advanced Robotics and Automated Systems (ARAS) Lab. Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran*

- In this paper proper deep learning approaches are combined with classical control methods.
- RoboEye is a spherical 3RRR parallel robot which has been developed for its high precision, and can be used for fast tracking tasks.
- Depth estimation, and object detection with a monocular camera for real time implementation is proposed here.
- For fast calculations, also to overcome manufacturing uncertainties, inverse kinematic equations are computed by a multi-layer perceptron (MLP) network based on real data.

14:30-16:30 148 ThC.20

Sensory Feedback Performance Improvement on RoboCab

Karen Abrinia[1], Moosa Ayati[1], Amin Abazari[2], Ali Haddad Tabrizi[2], Hadi Niknam Shirvan[2], Mostafa Shahbazzadeh[2], Erfan Safaee[2], Zeinab Maroufi[2], Mohammadreza Akrami[2], Amirhossein Oliaei Fasakhodi[2], Amirhossein Panahi[2]

[1] *School of Mechanical Engineering, University of Tehran, Iran*

[2] *Department of Mechatronics Eng. Faculty of New Sciences and Technologies, University of Tehran, Iran*

- An optimized and new method for the Advanced Driving Assistant system.
- Object detection was improved by parallel processing and machine learning; moreover machine vision was used for the detection of road, lines, and lanes.

Poster

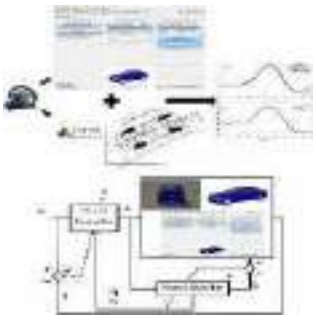
Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 166 ThC.21

Path tracking of an autonomous vehicle by means of an indirect adaptive neural controller

Abdollah Amirkhani[1], Masoud Shirzadeh[2], Nastaran Tork[3], Shahriar B. Shokouhi[4]
[1] *Iran University of Science and Technology ,Tehran, Iran*
[2] *Amirkabir University of Technology ,Tehran, Iran*
[3] *Iran University of Science and Technology,Tehran, Iran*
[4] *Iran University of Science and Technology, Tehran, Iran*

• This paper proposes an indirect adaptive neural controller for tracking the path of an autonomous vehicle
• Our proposed algorithm, controls the lateral movement of the autonomous car.

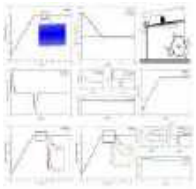


14:30-16:30 172 ThC.22

Fuzzy Static Sliding Mode Control For a Nonlinear Benchmark System

Sanam Hajipour, Ahmad Bagheri
Faculty of Mechanical Engineering, Guilan University, Iran

• This study investigates a method to improve the robustness and tracking errors of states of the ball and beam with respect to the stability of the system.
• Ordinary static sliding mode controller and fuzzy static sliding mode controller have been designed to meet this goal.
• To reduce the chattering phenomenon and for a better performance,Tanh() function has been utilized in the switching control law.
• Consequently, simulation results demonstrate convergence of states of the system to their desired values with an excellent performance,stability of both sliding surfaces and robustness of the system.

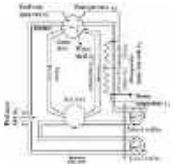


14:30-16:30 6 ThC.23

design and comparison of two PID control strategies to improve the performance of the boiler unit in a steam power plant

Shabnam Khodakaramzadeh, Hamed Moradi
Department of Mechanical Engineering, Sharif University of Technology, Tehran, Iran

• In this study, two PID-based control strategies are proposed to improve the performance of an industrial boiler unit in the steam power plant.
• In the first case a multi SISO (single input-single output) models, and in the second case, a MIMO (multi inputs-multi outputs) model have been considered.
• The objective of the control strategy is to improve the dynamic system performance in the presence of perturbations in output variables
• The proposed controller for the case with multi SISO models will have better convergence, because of tough interdependence of output variables and influences between them in MIMO model.

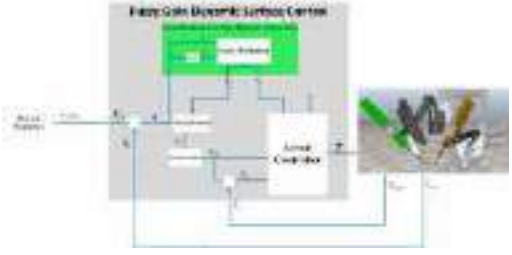


14:30-16:30 9 ThC.24

Robust Dynamic Surface Control of da Vinci Robot Manipulator considering Uncertainties: A Fuzzy Based Approach

Mohammad Hossein Hamedani[1], Mario Selvaggio[2], Mahtab Rahimkhani[3], Fanny Ficuciello[2], Hamid Sadeghian[4], Maryam Zekri[1], Farid Sheikholeslam[1]
[1] *Isfahan University of Technology Isfahan, Iran*
[2] *Università degli Studi di Napoli Federico II Napoli*
[3] *Engineering-Emerging Technologies, Tabriz University Tabriz, Iran*
[4] *Engineering Department, Isfahan University Isfahan, Iran*

• Dynamic Surface Control (DSC) is used to obtain a simple and robust controller structure to track the desired position by defining the effective dynamic surface.



Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 17 ThC.25

Finite-Time Event-triggered Consensus of Nonlinear Heterogeneous Multi-agent Systems

Shahram Yadollahi, Hajar Atrianfar

Department of Electrical Engineering, Amirkabir University of Technology, Tehran, Iran

- This paper investigate finite-time consensus of heterogeneous multiagent systems, consist of first-order and second-order nonlinear agents.
- The model of system is nonlinear and has uncertainties and external disturbances terms.
- Based on the local or the global information of the network, it will be decided when to broadcast the actual state measurements of the agents over the network and consequently the actuator update times.
- We use sliding mode control to make robust our strategy.

14:30-16:30 43 ThC.26

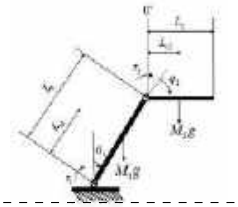
Data-driven observer-based model-free adaptive discrete-time terminal sliding mode control of rigid robot manipulators

Babak Esmaeili[1], Mina Salim[1], Mahdi Baradarannia[1], Ali Farzamnia[2]

[1] *Control department, Faculty of Electrical and Computer Engineering, University of Tabriz, Tabriz, Iran*

[2] *Faculty of engineering, Universiti Malaysia Sabah, Sabah, Malaysia*

- This paper aims to design a robust observer-based model-free adaptive controller for robot manipulators.
- Utilizing a terminal sliding surface, system outputs converge to the desired signals in finite-time and tracking accuracy of the controller is improved.
- Consequently, mathematical analysis guarantees the finite-time convergence and the stability of the closed-loop system. The comparative simulations lighten the superiority of the proposed work.



14:30-16:30 79 ThC.27

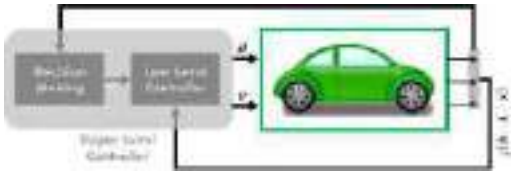
Autonomous Car Parking as a feature of ADAS Using ANFIS-FCM

Parisa Masnadi Khiabani[1], Hamidreza Rezaei Nedamani[1], Shahram Azadi[2]

[1] *Department of Advanced Vehicle Technologies, AIRIC*

[2] *Department of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran*

- This paper proposes a new approach for autonomous parallel parking, which is one of the challenging features of Advanced Driver Assistance Systems (ADAS).
- To model the expert driver, an Adaptive-Network-Based Fuzzy Interference System (ANFIS) based on Fuzzy C-Mean Clustering (FMC) is employed as an intelligent controller in the parking maneuver.
- The performance of the proposed controller is investigated through an accuracy index. The simulation results indicate that the accuracy index and the jerk value stay in an acceptable range.



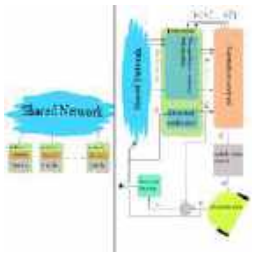
14:30-16:30 82 ThC.28

Distributed formation control of a networked multi-robot system using estimation based event-trigger communication mechanism

Sayedhossein Mousavizadeh Kashipaz, Alireza Mohammad Shahri

Department of Electrical Engineering,Iran university of science and technology, Tehran, Iran

- This study investigates a resource efficient method for performing formation control on a multi-robot system.
- bandwidth shortage is one the most important issues in every networked control system. It can potentialy limit robots number and abilities of the system
- Simulation results demonstrate the effectivness of proposed approach.



Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 83 ThC.29

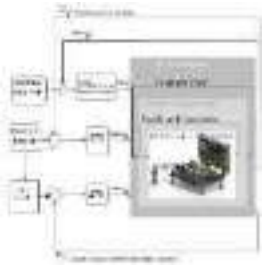
Designing a self-tuning regulator controller for a non-linear and MIMO Exoskeleton system assist test setup with adaptive decoupling

Shahla Zarrabi Rad[1], S. Kamal Hosseini Sani[1], Alireza Akbarzadeh[2]

[1] *Electrical Engineering Department, Ferdowsi University of Mashhad, Mashhad, Iran*

[2] *Mechanical Engineering Department, Ferdowsi University of Mashhad, Mashhad, Iran*

• In this paper, A test setup is made, which consists of an elastic actuator in order to simulate the human joint and exoskeleton movement and measure the amount of exoskeleton assist to the user.
• An adaptive controller with the indirect self-tuning regulator method, for the test setup control and the implementation of an assistive control is proposed.



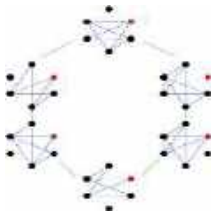
14:30-16:30 120 ThC.30

Resilient Consensus in Double-Integrator Systems with Switching Networks Facing Smart Attacks

Masoud Ahmadzadeh, Mohammad Javad Ahmadi, Mina Babahaji, Iman Sharifi

Faculty of Electrical Engineering, Amirkabir University of Technology, Tehran, Iran

• This paper proposes an algorithm for the double integrator multi-agent system to achieve consensus resiliently when the network facing attack.
• The network that considered is switching periodically and the attack in this study is smart and Normal W-MSR algorithm does not detect the malicious node in this case and the attack is applied on the position.
• A modified algorithm called MW-MSR is suggested in this paper and this algorithm can detect and remove the malicious node.



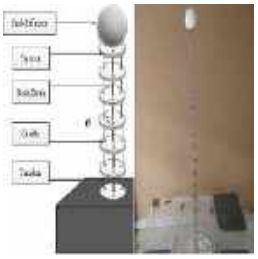
14:30-16:30 38 ThC.31

Linear vs. Nonlinear Modeling of Continuum Robotic Arms Using Data-Driven Method b

Aida Parvaresh[1], S. Ali A. Moosavian[1]

[1] *Advanced Robotics and Automated Systems (ARAS) Lab., Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran*

• In this paper, a modelling approach is proposed through the use of data-driven identification by linear and nonlinear models known as ARX.
• The proposed model can be used in further usage in various aspects, including inverse kinematics, trajectory generation, control and optimization.
• The results are compared and advantages and disadvantages of the proposed model in different applications are discussed.



14:30-16:30 152 ThC.32

Trajectory Control of a Robotic Carrier for Solar Power Plant Cleaning System

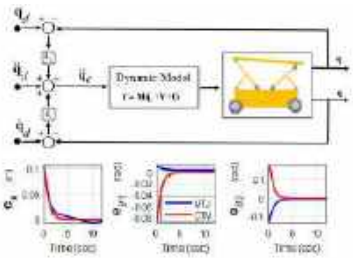
F. Hajiahmadi[1], M. Dehghani[2], P. Zarafshan[1], S. Ali A. Moosavian[3], S. R. Hassan-Beygi[1]

[1] *Department of Agro-Technology, College of Aburaihan, University of Tehran, Tehran, Iran*

[2] *Department of Food Technology, College of Aburaihan, University of Tehran, Tehran, Iran*

[3] *Dept. of Mechanical Engineering, K. N. Toosi Univ. of Technology, Tehran, Iran*

• Trajectroy control of a robotic carrier for solar power plant cleaning systems is presented.
• TJ and MTJ controllers are introduced as kinematics model based controllers.
• A CTM controller is designed as a dynamics model based approach.
• The results of the designed controllers are compared and discussed.



Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 47 ThC.33

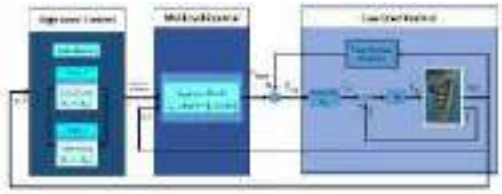
Impedance Control of a Knee Prosthesis with Frictional Torque Estimation

Shayan Jannati[1], Aghil Yousefi-Koma[1], Moosa Ayati[2], Saeed Rezaeian[1]

[1] *Center of Advanced Systems and Technologies (CAST), School of Mechanical Engineering, College of Engineering, University of Tehran, Tehran, Iran*

[2] *School of Mechanical Engineering, College of Engineering, University of Tehran, Tehran, Iran*

- This paper presents the effects of adding friction torque estimation block on impedance control of manufactured knee prosthesis.
- Fuzzy logic and LS identification method were used so as to estimate the demand friction torque in the movement of knee prosthesis.
- The results demonstrate proper knee angle tracking and also reducing the motor current demand in changing the movement direction of the knee prosthesis in swing phase.



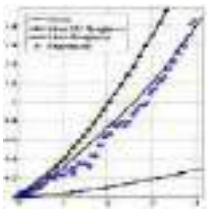
14:30-16:30 69 ThC.34

Modeling and simulation of the first and second phases of the viscoelastic biological particles considering simultaneous roughness of tip, particle, and substrate

Zahra Rastegar

Robotics Research Lab., School of Mechanical Engineering, Iran University of Science and Technology, Tehran, Iran

- New contact models have been developed which can be used for any kind of particle geometry.
- Rough viscoelastic contact models have been developed and compared with the elastic and viscoelastic ones.
- The radii of the asperities on the MCF-7 cells and substrate have been extracted experimentally.
- The second phase of the manipulation was simulated considering roughness and different environment.



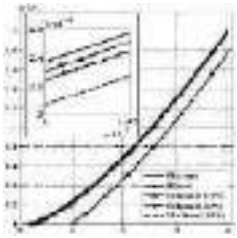
14:30-16:30 73 ThC.35

Path optimizing and cell's deformation in manipulation with AFM nano-robot using genetic algorithm

Yousef Habibi Sooha, Zahra Rastegar, Sahar Shahali

Robotics Research Lab., School of Mechanical Engineering, Iran University of Science and Technology, Tehran, Iran

- In this paper elastic-plastic models have been applied in the manipulation of biological particles.
- Manipulation process has been perfomed in different environments.
- Results have been compared with the elastic state to be confirmed.
- In this study the Chung elastic-complete plastic model has been used for contact mechanics of biological cells.



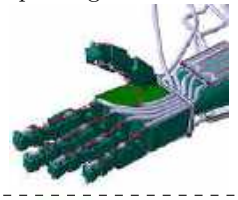
14:30-16:30 75 ThC.36

RoboGlove: Design of a Tendon-Driven Robotic Glove with Differential Mechanisms

Mehran Abbasi, S. Ali A. Moosavian

Center of Excellence in Robotics and Control, Advanced Robotics & Automated Systems (ARAS) Lab., Department of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran

- This study presents the design of a robotic glove to help patients grasp a variety of objects.
- The glove uses one DC motor and works based on diffrential, tendon-driven mechanisms.
- The differential mechanisms on the forearm and in the control unit presented, are designed based on attemps to minimize the response time while avoiding singularities.
- Finally, the functionality of the robotic glove is tested in performing two tasks. The results show the merits of the proposed glove.



Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

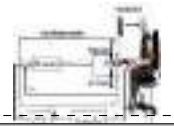
14:30-16:30 86 ThC.37

EMG-based Fatigue Adaptation in Admittance Control of Hand Rehabilitation

Maryam Mashayekhi, Majid M.Moghaddam

Department of Mechanical Engineering, Tarbiat Modares University, Tehran, Iran

- This paper proposes a novel algorithm for control of a hand rehabilitation robot based on user's electromyography signals.
- Prolonged muscle activity affects the user's ability for producing force and will cause fatigue in the user's muscle, which will result a change in user's emg signals.
- Rehabilitation therapy with constant task difficulty level may cause damage for the post-stroke patient, thus the problem is to design a system that is adoptable based on the user's condition.
- One of the main goals of rehabilitation treatment is to help post-stroke people to live independently,therefore three dimentional movements have been designed to exercise the muscles for doing normal routine activities.



14:30-16:30 99 ThC.38

RoboWalk Multiple-Sensor and Multipolar Data Fusion

Omid Mahdizadeh[1], Vahid Akbari[1], S. Ali A. Moosavian[1]

[1] *Center of Excellence in Robotics and Control,Advanced Robotics and Automated Systems (ARAS) Lab., Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran*

- RoboWalk is a two-legged rehabilitation assistimg robot, which helps users to carry a portion of the weight.
- In this paper, we propose an algorithm to correct the attitude and position error by means of an Adaptive Root Square Unscented Kalman Filter.
- Since there is no solid connection between the ground and the feet, the sensor's data may not lead to exact positioning configuration.
- Therefore, a new approach for estimating the position of the feet and the seat is presented.

14:30-16:30 107 ThC.39

Generating Synthetic Medical Images by Using GAN to Improve CNN Performance in Skin Cancer Classification

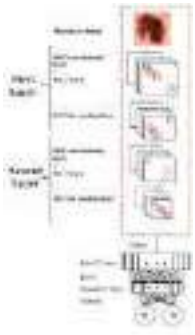
Pooyan Sedigh[1], Rasoul Sadeghian[2], Mehdi Tale Masouleh[3]

[1] *Department of Biomedical Engineering, Science and Research Branch, Islamic Azad University Tehran, Iran.*

[2] *Human and Robot Interaction Laboratory, Tehran, Iran.*

[3] *Human and Robot Interaction Laboratory, School of Electrical and Computer Engineering, University of Tehran, Tehran, Iran.*

- This paper presents a Convolutional Neural Network (CNN) to detect skin cancer.
- The classification performance of the designed trained CNN, which is presented in this study, without the obtained synthetic images is near 53%, but by adding the synthetic images to the primary database the performance of the model is increased to 71%.
- Consequently, Experimental results demonstrate the merits of the proposed approach.



14:30-16:30 160 ThC.40

Assessment of the Adaptive Sliding Mode Control of an Active Ankle Foot Orthosis with an Impedance Reference

Ahmad Bagheri, Davood Dorostkar, Mohammad Reza Zakerzadeh, Mohammad Jafar Sadigh, Mohammad Mahjoob

School of Mechanical Engineering, College of Engineering, University of Tehran, Tehran, Iran

- This study suggests an adaptive sliding mode controller scheme to compensate the imperfections of impedance at patient's ankle.
- The ankle will be modelled as a body with unknown specifications and a large unknown external force will act upon it.
- An adaptive sliding mode controller will then be utilized to apply the desired impedance, its stability will be discussed and simulations for three different body characteristics will be carried out.

Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 111 ThC.41

Real-time Fall Detection and Alert System Using Pose Estimation

Meysam Safarzadeh, Yusef Alborzi, Ali Najafi Ardekany

Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran

- Falling is the second cause of accidental injury deaths in the world. Although prevention is the best way, it's unavoidable in too many cases.
- Hence there is a vital importance of developing an intelligent system to detect fall events and inform the family or caregivers.
- we present a fast and automatic fall detection system using a single RGB camera and alert the caretakers using Arduino. we first find the locations of several body key points and then use them to predict if a fall has occurred or not.
- Finally, The experiments proved that the entire system is completely reliable and robust

14:30-16:30 116 ThC.42

Optimal Sensor Configuration for Activity Recognition during Whole-body Exercises

Amin M. Nasrabadi[1], Ahmad R. Eslaminia[2], Amir M. Soufi Enayati[2], Laila Alibiglou[3], Saeed Behzadipour[1]

[1] *Djavad Mowaffaghiyan Research Center in Neuro-rehabilitation Technologies Sharif University of Technology, Tehran, Iran*

[2] *Department of Mechanical Engineering Sharif University of Technology, Tehran, Iran*

[3] *Department of Neuroscience, School of Advanced Technologies in Medicine Iran University of Medical science, Tehran, Iran*

- Design and development of an intelligent wearable system using IMUs to recognize PD patients' mobility exercises called LSVT-BIG.
- Considering the cost, simplicity, and practicality, this paper proposes a method to find a smaller and more efficient number of IMUs that can accurately recognize the type of movement.
- An adaptation algorithm was utilized in order to maintain the quality of recognition for new users.

14:30-16:30 135 ThC.43

Design and prototyping of one degree of freedom rehabilitation robotic arm with variable weights

Mehdi Tale Masouleh[1], Mahdi Atashi Golestan[1], Amin Hamed[1]

[1] *Human & robot interaction Laboratory (TAAR) Lab. Faculty of Electrical & Computer Engineering, University of Tehran, Tehran, Iran*

- In this paper a novel concept is proposed to design a robotic arm for rehabilitating individuals with muscle disability for physiotherapy exercises and increasing muscles power.
- Experimental results demonstrate According to the performed experiments the device has 98% efficiency and only 2% of the force should be applied by the user

14:30-16:30 147 ThC.44

RoboWalk: Conceptual and Optimal Design

Sina Ghanaat, Mahdi Nabipour, S. Ali A. Moosavian

Advanced Robotics and Automated Systems (ARAS) Lab. Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran

- In this paper, the design procedure of the RoboWalk as a lower limb rehabilitation assisting robot is presented.
- There is a horizontal force component that is inevitably generated by the robot, and user may suffer from this and, in order to overcome this problem, a dimensional optimization is performed to minimize this component, besides the required torque to be exerted by user at knee joint.
- Finally, it is shown that this design is capable of fulfilling our goals and requirements using actuators with lower torque-speed specification.

Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 27 ThC.45

Experimental Robustness Evaluation of PID Controller for Position Control of a Cartesian Robot

Pedram Madani, Mobina Mobaraki, Sina Jahromi, Vahid Fakhari

Faculty of Mechanical and Energy Engineering, Shahid Beheshti University, Tehran, Iran

- In this paper, design, manufacture, and control of a Cartesian robot with three prismatic joints are investigated.
- A PID controlled is experimentally implemented, and the position of the end effector is controlled using AVR microcontroller.
- The effect of each PID coefficients on the system performance is studied and the robustness of the controller is evaluated in the presence of disturbance, noise and mass uncertainty.

14:30-16:30 60 ThC.46

Experimental Robustness Evaluation of PID Controller for Position Control of a Cartesian Robot

Sadegh Hajiabadi, Siavash Fathollahi Dehkordi

Robotics Research Laboratory, School of Mechanical Engineering, Iran University of Science and Technology, Tehran, Iran

- In this study for the first time, cooperative manipulators with closed kinematic chain have been modeled by efficient G-A formulation.
- In the inverse dynamic problem, optimum torques have been calculated by defining a cost function and distributing the energy.
- The determined model simulated for dual-arm manipulators contains three links in each chain and simulation has been done by MATLAB and verified by ADAMS software.
- Consequently, comparing results demonstrate the merits and accuracy of the proposed approach.

14:30-16:30 76 ThC.47

Dynamic modeling of industrial manipulator Hyundai HS165 in order to determine the dynamic load-carrying capacity for a specified trajectory

Mohammadreza Nakhaei Nezhad Fard[1], Amin Habibnezhad Korayem[1]

[1] *Robotics Research Laboratory., School of Mechanical Engineering,Iran University of Science and Technology, Tehran, Iran*

- This study investigates the kinematic and dynamic modeling of an industrial manipulator, Hyundai HS165, which is widely used in different industries.
- In this paper, direct and inverse kinematic equations are obtained using the DH parameters, and experimental tests verifiy the kinematic model.
- In this paper, a dynamic model is derived using the Lagrange method, and the load-carrying capacity for a specified trajectory is computed.

14:30-16:30 109 ThC.48

Kinematic Analysis and Optimal Design of a New 3T1R Parallel Mechanism

Mohammad Malekpour[1], Farid Kaviany[2], Rasul Fesharakifard[1], Mohammad A. Khosravi[2]

[1] *New Technologies Research Center. Faculty of Mechanical Engineering, Amirkabir University of Technology, Tehran, Iran*

[2] *Department of Electrical Engineering, Amirkabir University of Technology, Tehran, Iran*

- A new 4DOF parallel manipulator is presented in this paper.
- The position analysis and kinematic modeling for the mechanism are performed, and its workspace size and kinematic characteristic are examined.

Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

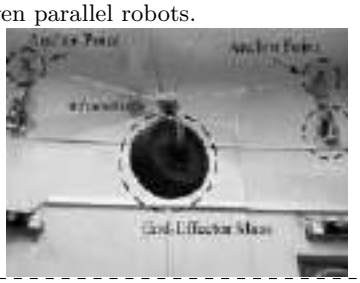
14:30-16:30 122 ThC.49

A Calibration Framework for Deployable Cable Driven Parallel Robots with Flexible Cables

Rooholla Khorrambakht, Hamed Damirchi, S. A. Khalilpour, Hamid D. Taghirad

Advanced Robotics and Automated Systems (ARAS) Lab. Faculty of Electrical Engineering, K. N. Toosi University of Technology, Tehran, Iran

• Investigating a method to improve the calibration accuracy in cable-driven parallel robots using multi-sensor data fusion.
• Cable flexibility, unmodeled rotation of feeder pulley and sagging in cables leads to unreliability in encoder data at certain configurations.
• This paper proposes an open-source calibrator tool and an effective calibration scheme for deployable cable-driven parallel robots.



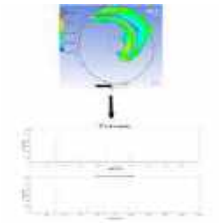
14:30-16:30 140 ThC.50

Study of Electromechanical coupling in A Motor-Driven Centrifugal Pump for Fault Detection and Diagnosis

Zahra Araste, Mohammad Jami moghaddam, Armin Toroghi, Ali Sadighi

[1]*Smart Electromechanical Energy Conversion Systems (SEECS) Lab. Faculty of Mechanical Engineering, University of Tehran, Tehran, Iran*

• The electromechanical coupling in an induction motor-driven centrifugal pump is studied and used as the cornerstone of a Condition Monitoring mehod.
• Impeller volute interaction is modeled and governing equations of the electric motor are developed using lumped-parameter approach.
• Time and frequency domain analysis are done for healthy and defective impeller with cut blades.
• Eventually, effect of the fault is studied on load torque and motor current.



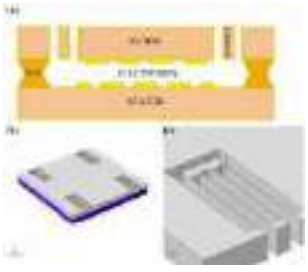
14:30-16:30 23 ThC.51

Performance Improvement of a Capacitive MEMS Accelerometer using Three Phase Sensing Approach

Mohammad Tahmasebipour, Mohammad Sangchap, Ali Vafaei

1Faculty of New Sciences and Technologies, University of Tehran Micro/Nano-Fabrication Technologies Laboratory, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran

• In this paper, a new approach to measure the acceleration by the capacitive MEMS accelerometer using the finite element analysis method is studied.
• This novel mechanism, which called the three-phase method, enhances the sensitivity of the accelerometer in comparison to the conventional two-phase measurement method.



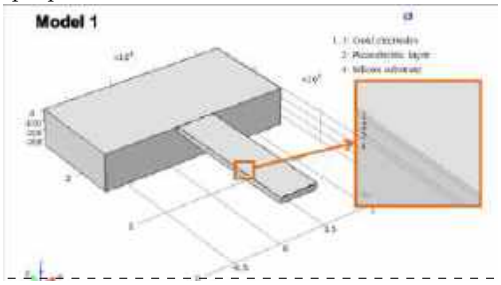
14:30-16:30 24 ThC.52

Piezoelectric Cantilever Micro-accelerometer Sensitivity Enhancement using Uniform Stress Distribution

Mohammad Tahmasebipour, Ali Vafaei, Mohammad Sangchap

Faculty of New Sciences and Technologies, University of Tehran, Micro/Nano-Fabrication Technologies Laboratory, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran

• In this study, a MEMS-based piezoelectric microaccelerometer is presented with dramatically increased sensitivity that was achieved by creating a uniform stress distribution in its piezoelectric layer.
• The frequency response and resonance modes of the proposed microaccelerometer were also studied.



Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 46 ThC.53

Improving the Performance of a Small-Scale CHP Plant using Fuzzy Sliding Mode Controller

Khatere Dakhili, Aghil Yousefi-Koma, Ahmad Esmaeilzade

Center of Advanced Systems and Technologies (CAST), School of Mechanical Engineering, University of Tehran ,Tehran, Iran

- In this study, the Thermodynamic model of a small-scale CHP plant based on a recuperated micro gas turbine (MGT) was developed.
- The aim of the paper is to design a Fuzzy – Sliding Mode (FSM) controller to control the speed of the turbine – compressor shaft and the turbine exhaust temperature simultaneously.
- The results show that the fuzzy – sliding mode controller improves the settling time in the shaft speed configuration at the desired value and maintains the exhaust gas temperature below the temperature limit.

14:30-16:30 54 ThC.54

Design and Fabrication of a Control Setup for a Miniature Mobile Robot Excited by Magnetic Field

Mobin Salehi[1], Hossein Nejat Pishkenari[1], Hassan Zohoor[2]

[1] *Nano-robotics Laboratory, Department of Mechanical Engineering, Sharif University of Technology, Tehran, Iran*

[2] *Department of Mechanical Engineering, Sharif University of Technology, Academician, Academy of Sciences of IR Iran, Tehran, Iran*

- In this paper, a dumb-bell shaped miniature robot is fabricated and actuated by the interaction of external magnetic field.
- According to the response of the system toward the magnetic actuation, a controller is introduced to control the position of the miniature robot on a plane.

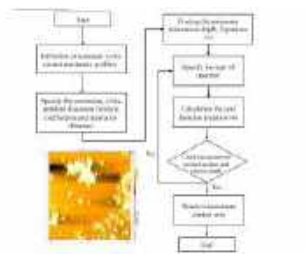
14:30-16:30 63 ThC.55

Finding the optimal contact function and path in nanomanipulation process-based on AFM nanorobot

Hesam Khaksar

Department of Mechanical Engineering,Iran University of Science and Technology,Tehran, Iran

- The article first deals with finding the best contact relationship for use in manipulation.
- In addition to contact verification, the nanomanipulation process routing is also investigated
- Routing is also performed on a real laboratory sample
- The main parts of this research include modeling, simulating and validating the results



14:30-16:30 64 ThC.56

Finding the optimal contact function and path in nanomanipulation process-based on AFM nanorobot

Hesam Khaksar

Department of Mechanical Engineering,Iran University of Science and Technology,Tehran, Iran

- The article first deals with finding the best contact relationship for use in manipulation.
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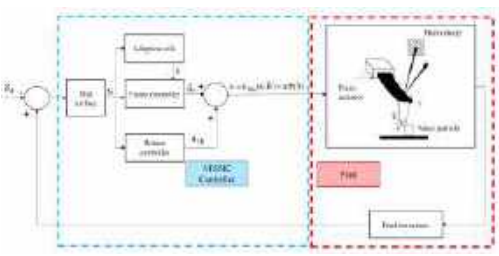


Poster

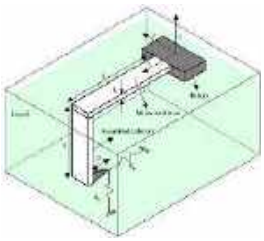
Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 129 ThC.57

Effect of Sidewall on Frequency Response and Flexural Sensitivity of AFM Cantilevers Immersed in Liquid based on Modified Couple Stress Theory

Behzad Saeedi[1], Ramin Vatankhah[2]
[1] *Department of Mechanical Engineering, Tarbiat Modares university ,Tehran, Iran*
[2] *School of Mechanical Engineering, Shiraz University, Iran*

• In this paper, the flexural resonant frequency and flexural sensitivity of an atomic force microscope (AFM) with an assembled cantilever probe (ACP) immersed in a liquid environment are analyzed utilizing the modified couple stress (MCS) theory.
• The ACP including a horizontal cantilever, a vertical extension, and a tip fixed at the free end of the extension.



14:30-16:30 141 ThC.58

Mathematical Model Extraction and State Space Construction for Nylon Based Smart Force Sensor

Saeed Rezaeian, Ahmad Reza Alghooneh, Aghil Yousefi-Koma, Reyhaneh A.Hosseininejad
Center of Advanced Systems and Technologies (CAST), School of Mechanical Engineering, College of Engineering, University of Tehran, Tehran, Iran

• In this paper, we will represent a model for Twisted and Coiled Actuator by means of theoretical concepts and experimental data.
• First, the preparation process will be explained, then the mathematical model for Voltage-Current and Current-Force will be driven via LS identification method.
• Then it will be validated by experiment which shows that this model can be exploited for future applications in which control of the temperature is necessary.

14:30-16:30 143 ThC.59

Evaluation of Monocular Visual-Inertial SLAM: Benchmark and Experiment

Seyed Jamal Haddadi[1], Eugênio de Bona Castelan Neto[1]
[1] *Department of Automation and Systems Engineering, Federal University of Santa Catarina, Florianopolis, Brazil*

• This study presents an improved tightly-coupled optimization-based Visual-Inertial SLAM is presented.
• In this way, by inclusion of a local scale, and leveraging an efficient vision factor in our cost function, and keeping the size of optimization local window, the accuracy of system is able to compete with the state-of-the-art visual-inertial SLAM algorithms, and system could operate in real-time.
• This paper proposes an effective scheme based on fusion of camera, load cell and inertial measurement unit data to provide more reliable posture information in presence of data accuracy challenges.

14:30-16:30 146 ThC.60

Robust Fuzzy Nonlinear Control of Microbeams Vibration with Piezoelectric Actuator and Electrostatic Force

Ashkan Vali, Ramin Vatankhah, Ehsan Azadi Yazdi
School of Mechanical Engineering, Shiraz University, Shiraz, Iran

• In this paper, transverse vibration control of a microbeam with nonlinear governing equations is investigated.
• The non-classical modified strain gradient theory is used to drive the governing differential equations of motion.
• The dynamic model considers the electrostatic force and the nonlinear effect of mid-plane stretching.
• The voltage produced by piezoelectric layers laminated on the beam is defined as the actuating control signal.

Poster

Chairs: Dr. Mohammad A. Khosravi & Dr. Ali Najafi Ardekany

14:30-16:30 149 ThC.61

Dynamics Modeling and Control of a Robotic Carrier of Solar Panel Cleaning System

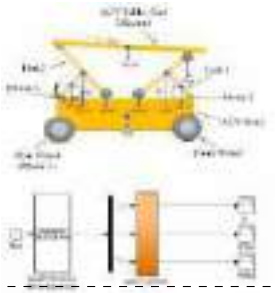
F. Hajiahmadi[1], P. Zarafshan[1], M. Dehghani[2], S. Ali A. Moosavian[3], S. R. Hassan-Beygi[1]

[1] *Department of Agro-Technology, College of Aburaihan, University of Tehran, Tehran, Iran*

[2] *Department of Food Technology, College of Aburaihan, University of Tehran, Tehran, Iran*

[3] *Dept. of Mechanical Engineering, K. N. Toosi Univ. of Technology, Tehran, Iran*

- A robotic carrier for solar power plants cleaning system is presented.
- Kinematic and dynamic modeling of the robotic carrier is presented.
- A model based controller is proposed and designed for actuator analysis.



The 7th RSI International Conference on

ROBOTICS & MECHATRONICS

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1st Call for Papers

The 8th RSI International Conference on Robotics and Mechatronics (ICRoM 2020)

18-20 November 2020 | Amirkabir University of Technology | Tehran | Iran

Objective:

The 8th RSI International Conference on Robotics and Mechatronics (ICRoM 2020) is organized by the Robotics Society of Iran (RSI) with the support of the Academy of Sciences of IR Iran, and collaboration of related scientific societies. This conference will be held to bring the relevant communities together, to exchange ideas and to create fruitful connections between active researchers and industrial professionals in these fields. The original research papers reported on the leading edge of science and technology will be peer-reviewed and presented in this conference, in order to consolidate the state of the art advancement in key areas of robotics and mechatronics.

Conference Topics:

The conference topics include (but are not limited to):
Serial and parallel manipulators, mobile and legged robots, humanoids, bio-inspired robots, rehabilitation and medical robotics, haptics, telesurgery, social robotics, field and service robotics, underwater and space robots, aerial robots, probabilistic robotics, micro- and nano-robots, reconfigurable robots, kinematics and dynamics, design and optimization, sensors, actuators, drivers, motion planning, trajectory generation, cooperation and coordination, object manipulation, motion and force control, cognitive robotics, machine vision, speech recognition, intelligent robots and mechatronics systems, learning robots, calibration, identification, telerobotics, visual servoing, automation, field instruments, measurement systems, MEMS, opto-mechatronics, embedded systems, intelligent robotics and mechatronics.

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Important date:

Paper Submission: **July 20, 2020**

Index and Journal Publication:

The official language of the conference is English. All papers are proposed to be included in the IEEE Xplore digital library and indexed by EI/Compendex, provided that they are presented at the conference. Selected papers are considered for possible Journal publications in the *International Journal of Robotics*, *Mechatronics Magazine*, and other scientific-research journals.

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