Mechatronics

Chairs: Prof. Gholamreza Vosooghi & Dr. Ali Chaibakhsh

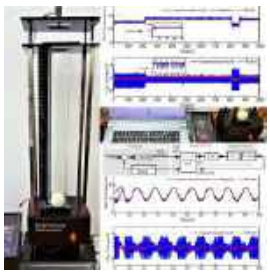
10:40-11:00 | 2 | WeA2.1

Modeling and Control of an Air Levitation Ball and Pipe Laboratory Setup

Amirreza Tootchi, Saeed Amirkhani, Ali Chaibakhsh

Intelligent System and Advanced Control (ISAC) Lab., Faculty of Mechanical Engineering, University of Guilan, Rasht, Iran

- In this paper, design, fabrication, modeling, and control of a low-cost ball and pipe air levitation laboratory system for educational purposes is investigated.
- This device would enhance the understandings and skills of students by providing a proper balance between the theoretical concepts and practical knowledge.



11:00-11:20 | 40 | WeA2.2

Activity Mining in a Smart Home from Uncertain and Temporal Databases

Josky Aizan[1], Cina Motamed[2], Eugene C. Ezin[3]

[1] *Institut de Math'ematiques et de Sciences Physiques, Universite d'Abomey-Calavi, B'enin*

[2] *Laboratoire d'Informatique Signal et Image de la Cote d'Opale, Universit'e du Littoral Cote d'Opale, France*

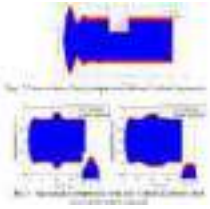
- This study focuses on improving the recognition accuracy of activities in a smart home using uncertain sequential pattern mining.
- Sensors, environmental constraints leads to uncertainty in data.
- This paper proposes an activity mining method based on uncertain and temporal sequential pattern mining to deal with data uncertainty.
- Consequently, Experimental results demonstrate the merits of the proposed approach.

11:20-11:40 | 56 | WeA2.3

Effect of hysteresis on the control of AFM Micro Robot by using both piezoelectric layer and base actuation

Alireza Habibnejad Korayem, Arash Hashemi

- In this paper, the effect of hysteresis on the control of atomic force microscope (AFM) multilayer micro cantilever (MC) have been studied.
- Governing equations are derived by using the modified couple stress theory (MCS).
- In addition, amplitude control of MC is examined in non-contact mode. The non-classic dynamic modeling of MC plays a great role in improving AFM control which differentiates it with previous studies. Two control methods of PID and nonlinear sliding mode control (SMC) are applied to the system.



11:40-12:00 | 104 | WeA2.4

Fault diagnosis of Combined Cycle Power Plant Using ELM

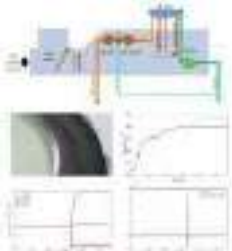
Hossein Eftekhary Davallo[1], Reza Bahrevar[2], Ali Chaibakhsh[3]

[1] *Faculty of Mechanical Engineering, University of Guilan, Rasht, Iran*

[2] *Department of Electrical and computer Engineering, University of Concordia, Montreal, Canada.*

[3] *Department of Mechanical Engineering, University of Guilan, Rasht, Iran.*

- This study investigates a method to detect and diagnosis the high-pressure tubes of a combined cycle power plant's high pressure steam generator was investigated
- An artificial intelligent fault detection method is used to detect the fault .
- This paper proposes an effective scheme based on Elm classifier, to diagnosis the type of the leakage.



Social Robotics

Chairs: Prof. Ali Meghdari & Prof. M Habibnejad Korayem

10:40-11:00 39 WeA3.1

"Taban": A Retro-Projected Social Robotic Head for Human-Robot Interaction

Mohammad Mokhtari[1], Azadeh Shariati[2], Ali Meghdari[1]
[1] *Center of Excellence in Design, Robotics, and Automation, Sharif University of Technology*
[2] *Department of Mechanical Engineering, University College London*

• This paper presents the design process and realization of a retro-projected social robotic head, "Taban".
• Taban is a cost-effective portable robot with a life-like robotic face which can produce different facial expressions, different 3D face animation avatars with the help of rear-projector in its head to projects animations onto a translucent 3D printout mask.
• The fabricated robotic head has a highly flexible facial system for both practical and research applications.

11:00-11:20 74 WeA3.2

Design, Fabrication, and Evaluation of the "Maya" Social Robot

Elham Ranjkar[1], Raman Rafatnejad[2], Ali Amoozandeh[2], Ali Meghdari[2], Minoo Alemi[2]
[1] *Islamic Azad University-West tehran Branch*
[2] *Center of Excellence in Design, Robotics, and Automation, Sharif University of Technology, Islamic Azad University-West tehran Branch*

• This paper covers the design process and fabrication of a robot called "Maya", whose purpose is to act as an intermediary in children's medical treatment progress.
• The mean score of the categories except for anxiety in UTAUT test shows that Maya's robot acceptance is fairly high with a score of 4.02 out of 5.

11:20-11:40 171 WeA3.3

Virtual Reality Robot for Rehabilitation of Children with Cerebral Palsy (CP)

Mojtaba Shahab[1], Mehran Raisi[2], Mehdi Hejrati[2], Alireza Taheri[1], Ali Meghdari[1]
[1] *Center of Excellence in Design, Robotics, and Automation, Sharif University of Technology*
[2] *Department of Mechanical Engineering, Sharif University of Technology*

• A virtual virtual robot-assisted game was designed for rehabilitation of children with cerebral palsy according to their physiotherapy schedule.
• The acceptance rate of the game was 75% by the CP group.
• It is indicated that the performance of CPs in all the activities was significantly weaker than their typically developing peers.

11:40-12:00 170 WeA3.4

Human-Robot Interaction based on Facial Expression Imitation

Alireza Esfandbod, Zeynab Rokhi, Alireza Taheri, Minoo Alemi, Ali Meghdari
Center of Excellence in Design, Robotics, and Automation, Sharif University of Technology

• Implement a FER algorithm on a robotic platform to identify human emotional states
• Imitating the human's emotional states by robot
• This paper is a report on the performance of the imitation systems implemented on the RASA robotic platform

Medical Robotics I

Chairs: Prof. S. Ali A. Moosavian & Prof. M Mohammadi Moghadam

10:40-11:00 | 29 | WeA4.1

Adaptive Tracking Control Based on GFHM for a Reconfigurable Lower Limb Exoskeleton

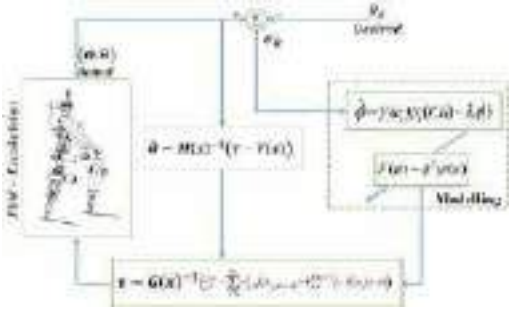
Amin A.B Daryan[1], S. Mohammad Tahamipour-Z.[2], Alireza Akbarzadeh[3]

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

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

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

- In this paper, an adaptive tracking control based on Generalized Fuzzy Hyperbolic Model (A-GFHM) is proposed for a lower limb exoskeleton.
- The proposed controller has proven to be highly capable of controlling MIMO non-linear systems



11:00-11:20 | 50 | WeA4.2

Conceptual Design of an Active Body Weight Support System Using a Linear Series Elastic Actuator

Amirmuhammad Mirzaee, Majid Mohammadi Moghaddam, Aliakbar Mirzaee Saba

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

- In this paper, a novel active body weight support (BWS) system comprises of a series elastic actuator to provide unloading force against gravity, has been presented.
- By using a set of mechanical and electrical components and employing control method, cable force could be controlled precisely to stablish regular gait training.
- In this novel effective design,only a small percentage of the load is applied on the series elastic actuator, which leads to more precise cable force control and lower power expenditure
- Consequently, Simulation studies demonstrate the merits of the system.

11:20-11:40 | 102 | WeA4.3

Human Body Modeling for Ground Contact Force Estimation of RoboWalk

Farshid Absalan, S. Ali A. Moosavian

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

- This study investigates a method to evaluate efficiency of foot contact model for human-Robowalk augmented dynamics.
- Three points of collision with the ground were considered for each foot.
- The dynamic model of nineteen DOF with sixteen revolute joints was generated by the Euler-Lagrange method. Then, the simulation results were compared with the experimental data and verified by inverse dynamics result.
- Consequently, The closeness of simulation to the experimental data of the human pelvis showed that the system parameters were estimated correctly.

11:40-12:00 | 110 | WeA4.4

Simulation Analysis of Human-RoboWalk Augmented Model

Mohamad R. Mohamadi[1], Vahid Akbari[1], Omid Mahdizadeh[1], Mahdi Nabipour[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*

- The dynamics of the human and RoboWalk are obtained using the Newton-Euler (NE) and the Recursive Newton Euler Algorithm (RNEA).
- then, RoboWalk is imported to the human model in Opensim software and the augmented model is obtained by defining some constraints and joint models. Controllers are then designed for the human and RoboWalk in Opensim.
- It is shown that the NE and RNEA methods match very closely and both of the models possess the same behavior as the Opensim model.

Medical Robotics I

Chairs: Prof. S. Ali A. Moosavian & Prof. M Mohammadi Moghadam

12:00-12:20 154 WeA4.5

Design and Construction of a Planar Robotic Exoskeleton for Assessment of Upper Limb Movements

Akbar Nikzad Goltapeh, Saeed Behzadipour, Majidi Hajihosseinali

Departement of Mechanical Engineering, Sharif University of Technology, Tehran, Iran

- In this paper, we designed and constructed a novel upper-limb exoskeleton robot that can be helpful in proprioception assessments and rehabilitation of impairments after stroke.
- The Exoskeleton consists of two 2-DOF arms which are fully adjustable to accommodate users of different sizes.

Robot Control II

Chairs: Dr. Jihad Sahili & Dr. H Nejat Pishkenari

15:00-15:20 41 WeB1.1

A Cascaded kalman filter model-aided inertial navigation system for underwater vehicle

Jihad Sahili[1], Hussein Alawieh[2]
[1] *Associate professor,Department of mechanical engineering, faculty of engineering, Lebanese university, Al hadath, Beirut, Lebanon*
[2] *Department of mechanical engineering, faculty of engineering, Lebanese university, Al hadath, Beirut, Lebanon*

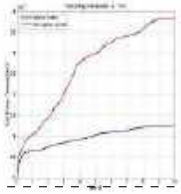
- Modeling of stochastic and deterministic errors of MEMS IMU.
- Design of a drift free complementary indirect kalman filter for attitude and heading reference system.
- Design of an extended kalman filter for the fusion of a dynamic model with the measurements of IMU for a model aided inertial navigation system.

15:20-15:40 53 WeB1.2

Optimal Control of a High Maneuverable Micro-Swimmer in Low Reynolds Number Flow to Reduce Energy Consumption

Hossein Abdi, Hossein Nejat Pishkenari
Nano Robotics Laboratory, Department of Mechanical Engineering, Sharif University of Technology, Tehran, Iran

- This study investigates a method to decrease the energy consumption of a high-maneuverable self-propelled micro-swimmer.
- This paper proposes an optimal controller to adjust the orientation of the micro-swimmer matching to its surrounding flow-field.
- Additionally, in this study, a dynamic modeling of a micro-swimmer and its hydrodynamic effects on its surrounding flow-field is proposed.
- Consequently, simulation results demonstrate the merits of the proposed optimal control.

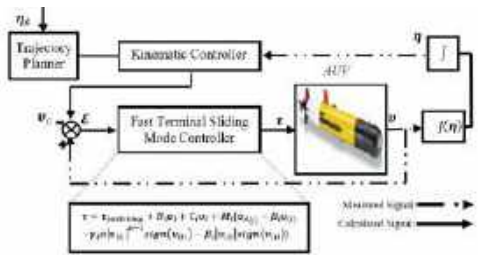


15:40-16:00 66 WeB1.3

Tracking Control of an Autonomous Underwater Vehicle: Higher-Order Sliding Mode Control Approach

Fahimeh S. Tabataba'i-Nasab, S. Ali A. Moosavian, Ali Keymasi Khalaji
Advanced Robotics and Automated Systems (ARAS) Lab., Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran

- In this study, the new control algorithm for tracking operation of AUV in 3D workspace is proposed
- the control algorithm is based on terminal sliding mode control technique, which leads to fast response, time-limited convergence and robustness against uncertainties and external disturbances.
- Stability of the controller in presence of external disturbances is developed using Lyapunov method.

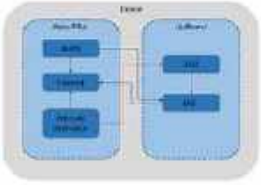


16:00-16:20 67 WeB1.4

Position Estimation for Drones based on Visual SLAM and IMU in GPS-denied Environment

Hamid Hamid Didari Khamseh Motlagh[1], Faraz Lotfi[1], Hamid D. Taghirad[1], Saeed Bakhshi Germi[2]
[1] *Advanced Robotics and Automated Systems (ARAS) Lab., Faculty of Electrical Engineering, K. N. Toosi University of Technology, Tehran, Iran*
[2] *Machine Learning Research Group Tampere University, Tampere, Finland*

- This study investigates a method to navigate drone in GPS-denied Environment.
- Two different approaches for scale estimating are presented and compared to each other.
- Altitude, attitude and position controller designed by cascade controller.
- Experimental results are done with a drone that has non-commercial Autopilot.



Robot Control II

Chairs: Dr. Jihad Sahili & Dr. H Nejat Pishkenari

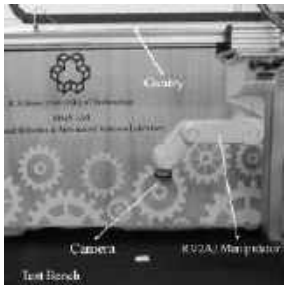
16:20-16:40 81 WeB1.5

Implementation of an improved moment-based visual servoing controller on an industrial robot

Parisa Masnadi Khiabani, Javad Ramezanzadeh, Hamid D. Taghirad

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

• This study proposes a robust nonlinear controller for moment based visual servoing.
• Utilizing proportional integral sliding mode controller could handle the nonlinear nature of system.
• Different experiments has been done to demonstrate the improved performance of the suggested controller.



Aerial Robots

Chairs: Prof. Mohammad Bagher Menhaj & Dr. Payam Zarafshan

15:00-15:20 | 13 | WeB2.1

Fault-Tolerant Control of a Multirotor Unmanned Arial Vehicle applying Particle Swarm Optimization

Jihad Sahili[1], Hussein Mazeh[2]
[1] *Associate professor,Department of mechanical engineering, faculty of engineering, Lebanese university, Al hadath, Beirut, Lebanon*
[2] *Research-Center-in-Engineering, faculty of engineering, Lebanese university, Al hadath, Beirut, Lebanon*

• In this work, a fault tolerant control strategy based on PSO algorithm hexarotor UAV is proposed for the study case of motor(s) failure(s).
• The suggested strategy is validated with acceptable performance results by simulation and real outdoor flight experiments.
• The implemented PSO algorithm shows a good time convergence performance which can be safely implemented onboard the vehicle.

15:20-15:40 | 14 | WeB2.2

LinBot – Design, Analysis, and Field Test of a Novel Power Transmission Lines Inspection Robot

Amin Fakhari, Amir Mostashfi
Department of Mechanical Engineering, Isfahan University of Technology, Isfahan, Iran

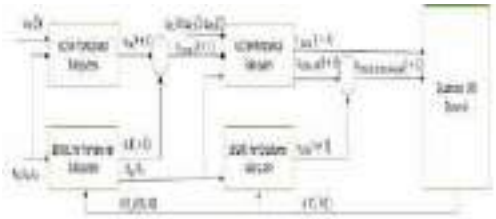
• This study investigates design, analysis, and field tests of an innovative inspection robot (LinBot) for high-voltage power transmission lines.
• This robot is utilized for moving on ground wires of transmission lines with the aim of inspection and fault detection of phase lines.
• Thanks to active and passive mechanisms designed in this robot, it is able to surmount all different ground wire obstacles including warning balls, clamps, and tower tips, and this is a unique capability of this robot among all other line inspection robots.
• Performance of the robot prototype manufactured in the laboratory is evaluated in the real field experimentally.

15:40-16:00 | 22 | WeB2.3

Back-Stepping Integral Sliding Mode Control with Iterative Learning Control Algorithm for Quadrotor UAV Transporting Cable-Suspended Payload

Davood Allahverdy[1], Ahmad Fakharian[2], Mohammad Bagher Menhaj[3]
[1] *Science and Research Branch, Islamic Azad University Tehran, Iran*
[2] *Faculty of Electrical, Biomedical and Mechatronics Engineering, Qazvin Branch, Islamic Azad University Qazvin, Iran*
[3] *Department of Electrical Engineering, Amirkabir University of Technology Tehran, Iran*

• This study investigates a method to improve the accuracy, robustness, disturbance rejection in Quadrotor UAV Transporting Cable-Suspended Payload by using a nonlinear method and iterative learning algorithm.



16:00-16:20 | 52 | WeB2.4

Path Planning for a UAV by Considering Motion Model Uncertainty

Hossein Sheikhi Darani, Ali Noormohammadi-Asl, Hamid D. Taghirad
Advanced Robotics and Automated System (ARAS), Industrial Control Center of Excellence (ICEE), Faculty of Electrical Engineering, K. N. Toosi University of Technology, Tehran, Iran

• This study investigates a method on path planning problem for a UAV in a 2D plane, by considering the uncertainty in the robot's motion model.
• while there are other uncertainties like uncertainty in the environment's map, we rely on EKF localization output as accurate results.
• Consequently, simulation, and real implementation demonstrate the promising results of the proposed approach.

Aerial Robots

Chairs: Prof. Mohammad Bagher Menhaj & Dr. Payam Zarafshan

16:20-16:40 78 WeB2.5

Wind Compensation in Trajectory Tracking of a Fixed Wing UAV Using a Nonlinear Model Predictive Controller based on the Particle Swarm Optimization

Hadi Nobahari[1], Alireza Sharifi[2]
[1] *Faculty of Aerospace Engineering, Sharif University of Technology, Tehran, Iran*
[2] *Department of Aerospace Engineering, Sharif University of Technology, Tehran, Iran*

- A nonlinear heuristic controller, called NMPC-PSO, is utilized for trajectory tracking of a fixed wing Unmanned Aerial Vehicle (UAV).
- NMPC-PSO addresses a nonlinear model predictive controller based on the particle swarm optimization method.
- Stability of the NMPS-PSO is proved and analyzed.

Wheeled Robotics

Chairs: Prof. Majid Nili Ahmadabadi & Dr. Siavash Fathollahi Dehkordi

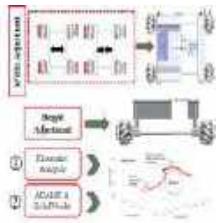
15:00-15:20 55 WeB3.1

Omnidirectional mobile robot design with height and width adaptation

Erfan Karamipour, Siavash Fathollahi Dehkordi

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

• In this study, an innovative design is presented in order to skip obstacles with dimensions adjustments.
• The width and height adjustment is done through Mecanum wheels rotation and linear actuator respectively.
• The results obtained by kinematic analysis and simulation in ADAMS are compatible with each other.
• By means of these improvements not only obstacle passing time is reduced but also the energy consumption is optimized.

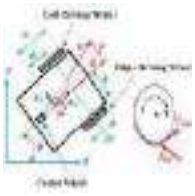


15:20-15:40 57 WeB3.2

Dynamic modeling and sliding mode control of a wheeled mobile robot assuming lateral and longitudinal slip of wheels

Narges Ghobadi, Siavash Fathollahi Dehkordi

• In this paper, the dynamic model of a wheel¬ed mobile robot(WMR) is derived by assuming the longitudinal and lateral slip of the wheels without changes in the states of the ideal system.
• Due to the uncertainties in the studied system, the sliding mode controller(SMC) with respect to the uncertainty-resistant structure is used to control the robot and the stability of the system is guaranteed by Lyapunov method.
• The results show that the WMR with SMC method can track the desired path considering slippage with an acceptable error.



15:40-16:00 59 WeB3.3

N-axis mobile robot motion equations derivations by considering the effects of nonlinear phenomena: slip and wheels' motor backlash

Mostafa Aghajari, Siavash Fathollahi Dehkordi

Robotics Research Laboratory, Center of Excellence in Experimental Solid Mechanics and Dynamics, School of Mechanical Engineering, Iran University of Science and Technology, Tehran, Iran

• In this article, using Euler-Lagrange equations, the motion equation of an n-axis wheeled mobile robot is derived.
• The effects of flexibility, backlash, and friction of wheels are taken into consideration when deriving the motion equations.
• This robot can be utilized in space exploration and uncharted territories as a rescue robot.

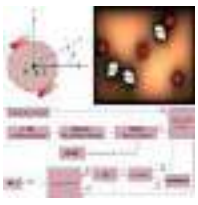
16:00-16:20 80 WeB3.4

Sliding Mode Controller via Extended Kalman Filters For Mobile Robot

Hanie Marufkhani, Behnam Jabbari Zadeh, SeyedReza Hashemirad, Iman Sharifi

Amirkabir University of Technology (Tehran Polytechnic)

• This paper uses the Extended Kalman Filter algorithm to estimate the position of the Mobile Robot (MR). The position's estimation of other robots and the landmarks are needed to avoid the collision in autonomous systems. Solving the SLAM problem is necessary because the position of other mobile robots are unknown for each robot.
• The robot's continuous kinematic model is transformed into a discrete kinematic model, and it is used to solve the SLAM problem.
• A sliding mode controller is applied to the MR's discrete system, causing no collision between the MRs and landmarks in the environment.



Wheeled Robotics

Chairs: Prof. Majid Nili Ahmadabadi & Dr. Siavash Fathollahi Dehkordi

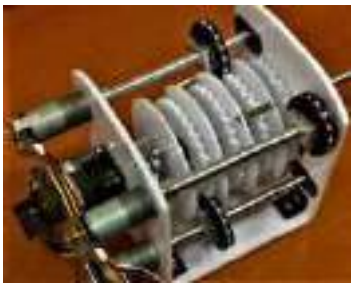
16:20-16:40 158 WeB3.5

Realization of Nonlinear Adaptive Compliance: Towards Energy Efficiency in Cyclic Tasks

Rezvan Nasiri[1], Arjang Ahmadi[1], Majid Nili Ahmadabadi[1]

[1] *All authors are with the Cognitive Systems Laboratory, Control and Intelligent Processing Center of Excellence (CIPCE), School of Electrical and Computer Engineering, College of Engineering, University of Tehran, Iran.s*

- In this paper, we present a mechanism which is a realization for nonlinear adaptive compliance.
- We present an adaptation rule for online nonlinear torque-deflection profile optimization.
- The proposed approach in this paper, can improve the energy efficiency of the robotic system performing cyclic tasks.



Medical Robotics II

Chairs: Prof. Heidar Ali Talebi & Prof. Farid Najafi

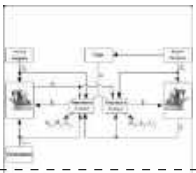
15:00-15:20 | 18 | WeB4.1

Robust Impedance Control for Dual User Haptic Training System

Reza Heidari, Mohammad Motaharifar, Hamid D. Taghirad

Advanced Robotics and Automated Systems (ARAS), Industrial Control Center of Excellence (ICCE), Faculty of Electrical Engineering, K.N. Toosi University of Technology, Tehran, Iran.

- This paper proposes a switching gain impedance control scheme for surgery training in dual user haptic systems.
- The control parameters are switched to transfer the task authority between trainee and trainer through a mechanical pedal.
- A Robust control algorithm guarantees that the closed-loop dynamics of the system reaches the desired impedance, even in the presence of uncertainties.
- Consequently, Simulation results demonstrate the merits of the proposed approach in haptic surgery training.



15:20-15:40 | 19 | WeB4.2

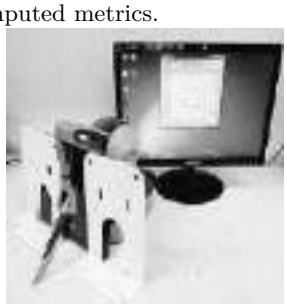
Skill Assessment Using Kinematic Signatures: Geomagic Touch Haptic Device

Negar Sadat Hojati, Mohammad Motaharifar, Hamid D. Taghirad, Ahad Malekzadeh

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

[2] *Faculty of Mathematics, K.N. Toosi University of Technology, Tehran, Iran*

- This study investigates a method to evaluate the practical skill level based on extraction features from kinematic data of motion.
- This paper proposes a method to classify skill level based on extracted features from temporal signal analysis and Discrete Wavelet Transform coefficients of computed metrics.



15:40-16:00 | 30 | WeB4.3

A Modified Patient-Cooperative Robot-Aided Gait Rehabilitation Algorithm Based on Path Control

Asghar Mahmoodi Khomami, Farid Najafi

Faculty of Mechanical Engineering,University of Guilan, Rasht, Iran

- This study investigates the design of an Assist-as-Needed control method for the exoskeleton gait rehabilitation robot developed in University of Guilan.
- The proposed control method is based on "Path Control" method used for Lokomat rehabilitation robot.
- Finally, simulation results are presented for the proposed method to show the effectiveness of the supportive torques to create better kinematic response in comparison to the "Path Control" method.

16:00-16:20 | 31 | WeB4.4

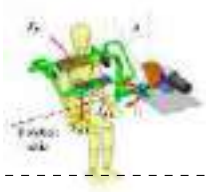
Design, Modeling and Fabrication of an Isokinetic Exercise Device for Back Muscles Strength and Endurance

Ebrahim Panahpoori[1], Mohammad Mahjoob[2], Ali Sadighi[1]

[1] *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, Center for Advanced Orthopedic Studies, BIDMC, HMS, Harvard University*

- This study investigates Design, Modeling and Fabrication of an Isokinetic Exercise Device for Back Muscles rehabilitation.
- Low back pain is mainly associated with the weakness of back muscles that increases the risk of spine damage.
- The muscles torque is monitored via a mechanism composed of two single-point load cells and an electrical motor with closed loop control is used to provide the required constant speed (in the isokinetic operation mode).



Medical Robotics II

Chairs: Prof. Heidar Ali Talebi & Prof. Farid Najafi

16:20-16:40 91 WeB4.5

Optimal Design and Dynamic Analysis of a Hybrid Manipulator for Intra-ocular Surgeries

Haleh Hayati, Mohammad Taefi, Mohammad A. Khosravi, H. A. Talebi

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

- This study aims to develop a new robot for vitreo-retinal eye surgery applications, referred to as PERSIS (Precise Robotic System for Intraocular Surgeries).
- In the eye surgeon robot, due to the accuracy required in routing the surgical instrument, a closed-form of equations of motion for hybrid mechanism of PERSIS is generated.
- According to the results, the proposed parallel robot has excellent maneuverability within the intended range.

Legged Robots

Chairs: Prof. Aria Alasty & Prof. Aghil Yousefi-Koma

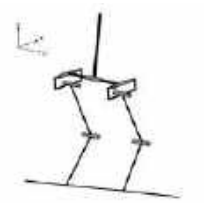
09:30-09:50 | 7 | ThuA1.1

Designing a Fractional Order Back-Stepping Controller Based on GPI Observer for a 3D Biped Robot

Mona Raoufii, Mehdi Edrisi

Department of Electrical Engineering, University of Isfahan, Isfahan, Iran

- Regarding high angular rates and impact phases of the biped during dynamic walking, instantaneous changes of the joints velocities are problematic that will be addressed in this study.
- GPI observers are used to estimate time-varying disturbances and possible uncertainties.
- The back-stepping technique avoids the state transformation or higher-order derivatives of the controlled state.
- Consequently, Results demonstrate the merits of the proposed approach.



09:50-10:10 | 11 | ThuA1.2

Ball Path Prediction for Humanoid Robots: Combination of k-NN Regression and Auto-regression Methods

Yasaman Mirmohammad[1], Shayan Khorsandi[2], Mohammad Navid Shahsavari[1], Behnam Yazdankhoo[3], Soroush Sadeghnejad[1]

[1] *Bio-Inspired System Design Lab., Amirkabir University of Technology, Tehran, Iran*

[2] *School of Computer Engineering, Iran University of Science and Technology, Tehran, Iran*

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

- Consequently,results indicate that the adaptive scheme can robustify the prediction in presence of an external disturbance,and make the prediction more accurate.

10:10-10:30 | 153 | ThuA1.3

Design, Fabricate and Description of a Low Cost Optical Tactile Sensor

Leila Hajshahvaladi[1], Arsalan Amralizadeh[2], Amin Hamed[2], Hamed Nazemi[3], Mehdi Tale Masouleh[2]

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

[2] *Human & Robot Interaction Laboratory, University of Tehran*

[3] *Department of Mechanical Engineering, Amirkabir University of Technology, Tehran, Iran*

- This paper presents the design and fabrication of an optical tactile sensor unit for the measure of the physical human-robot interaction pressure.
- This sensor consists of an infrared transmitter and an infrared receiver, which is covered by a soft silicone layer in the form of a pyramidal frustum.

10:30-10:50 | 157 | ThuA1.4

Design and Development of a Pressure-Sensitive Shoe Platform for Nao H25

Amir Mehdi Shayan, Arman Khazaei, Amin Hamed, Mehdi Tale Masouleh

School of ECE, University of Tehran, Tehran, Iran

- This study introduces a smart pressure-sensitive platform designed in a modular manner similar to the shape of the foot of the Nao H25 V5 humanoid robot.
- The main purpose of the developed shoe system is to accurately estimate and monitor ground reactive forces and the plantar pressure distribution of the foot of the Nao in real-time.
- Unique pressure sensing elements was designed and developed and four sensing elements have been placed at the bottom of the shoe.
- The presented sensing element consists of a barometric pressure sensor and a silicone coating.

Serial & Parallel Manipulators

Chairs: Prof. M Reza Hairi Yazdi & Dr. Mehdi Tale Masouleh

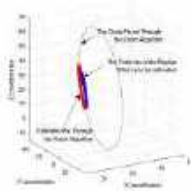
09:30-09:50 33 ThuA2.1

Spatial Shape Estimation of a Tendon-Driven Continuum Robotic Arm Using a Vision-Based Algorithm

Yasaman Pedari, Aida Parvaresh, 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, a procedure for spatial shape estimation of a tendon-driven continuum manipulator is proposed using two cameras.
• The webcams are used to capture the images of LEDs, installed along the manipulator, which are exploited to determine their position.
• Shape of each section is estimated as the an arc of the circular intersection of a sphere and a plane, utilizing the position of the LEDs .
• The proposed algorithm was tested on a calibration model of the manipulator, revealing appropriate error.



09:50-10:10 36 ThuA2.2

Data-Driven Identification of the Jacobian Matrix of a 2-DoF Spherical Parallel Manipulator

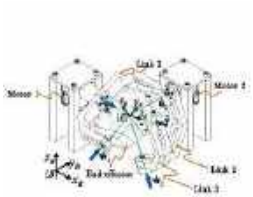
Seyed Emad Askarinejad[1], Ali Fahim[2], Mohammad Reza Hairi Yazdi[1], Mehdi Tale Masouleh[3]

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

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

[3] *Human and Robotic Interaction Laboratory, University of Tehran, Tehran, Iran*

• In this study, a data-driven method called Sparse Identification of Nonlinear Dynamics (SINDy) is used to find the the nonlinear equation of Jacobian that maps angular velocities of end-effector to angular velocities of actuators.
• The results of this study shows the accuracy of SINDy method. Moreover, the calculation time has been significantly reduced compared to the analytical approaches.



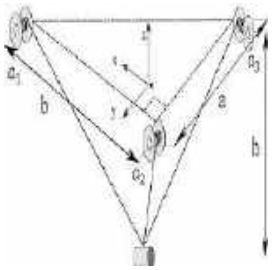
10:10-10:30 62 ThuA2.3

Stabilization of Cable Driven Robots Using Interconnection Matrix: Ensuring Positive Tension

Mohammadreza Jafari harandi[1], S. Ahmad khalilpour[1], Hamed Damirchi[1], Hamid D. Taghirad[1]

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

• This article studies a method to ensure positive tension in cable-driven parallel robots using interconnection matrix.
• Point to point stabilization in cable driven robot when the path is not pre-determined is a challenging problem because cables can merely pull.
• The results are verified through simulation on a 3-DOF suspended cable driven robot.



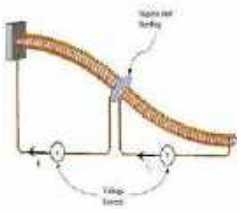
10:30-10:50 87 ThuA2.4

On the dynamics of a magnetostriction-based soft robotic manipulator: Closed form and Machine Learning approaches

Pouya Abdollahzadeh, Saber Azizi

Mechanical Engineering Department, Urmia University of Technology, Urmia, Iran

• The impetus of this study is to investigate the dynamics of a flexible robotic manipulator.
• Proposed manipulator's links act as actuators and it does not need any external actuators.
• Nonlinear equation of motion is derived based on Euler-Bernoulli beam theory.
• An Artificial Neural Network and a Neuro-fuzzy network is used to address the inverse dynamic problem.



Planning & Control

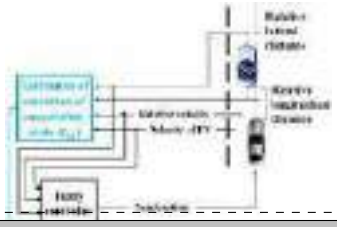
Chairs: Prof. Ali Ghaffari & Dr. Vahid Azimirad

09:30-09:50 | 25 | ThuA3.1

Fuzzy control of anticipation and evaluation behaviour in real traffic flow

Farzam Tajdari[1], Ali Ghaffari[2], Alireza Khodayari[3], Ali Kamali[4], Nima Zhilakzadeh[5], Naeim Ebrahimi[6]
[1] *School of engineering, Aalto University, Espoo, Finland*
[2] *K. N. Toosi University of Technology, Tehran, Iran*
[3] *Pardis Branch, Islamic Azad University, Tehran, Iran*
[4] *Amirkabir University of Technology, Tehran, Iran*
[5] *I.K.I University, Qazvin, Iran*
[6] *Sharif University of Technology, Tehran, Iran*

- This paper presents an approach to consider lane changing behavior during car following bahaviour as new generation of Advanced driver-assistance systems.
- This study proposes an innovative input-output fuzzy controller based on NGSim data-set, and human driving behaviour, first, to improve the quality of drive than real driver, and second increase time efficiency, fuel efficiency, safety, and reduced total travel time and length of queue.



09:50-10:10 | 68 | ThuA3.2

2D path planning of the viscoelastic particles in the presence of random stationary and moving obstacles using AFM nano-robot

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

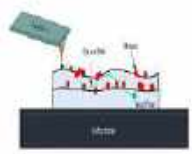
- In this paper path planning for the viscoelastic biological particles has been done.
- The path planning performed on a real image of HN-5 cells.
- In this paper the optimum path planning based on the cost function minimization has been done.
- According to the importance of the accuracy and also tool and particle's damage, cost function includes tool error, particle deformation and applied force on AFM.

10:10-10:30 | 72 | ThuA3.3

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

Sahar Shahali[1], Zahra Rastegar[1]
[1] *Robotics Research Lab., School of Mechanical Engineering, Iran University of Science and Technology, Tehran, Iran*

- This paper makes it possible to use the dynamics of the three-dimensional manipulation of particles in routing process.
- In this research, the path planning of biological particles without encountering random obstacles is investigated by considering their mechanical and morphological properties.
- Consequently,This study presents an effective method that can be used in treatment of cancer tumors in order to reduce some side effects such as loosing hair during the chemotrapy.

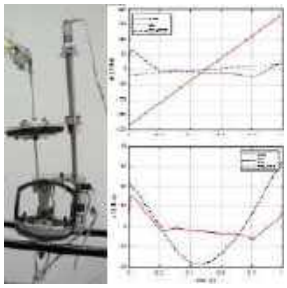


10:30-10:50 | 103 | ThuA3.4

Hybrid Path Planning of Robots Through Optimal Control and PSO Algorithm

Mohammad Tayefe Ramezanlou, Vahid Azimirad, Manizhe Zakeri
Department of Mechatronics Engineering, University of Tabriz, Tabriz, Iran

- A hybrid algorithm for robot's path planning is proposed, which consists of the optimal control and PSO.
- The optimal control is used to simplify the equations and applying constraints on the system.
- There is no dependency on the initial guess in this method.



Medical Robotics III

Chairs: Prof. Hassan Zohoor & Prof. Alireza Akbarzadeh

09:30-09:50 61 ThuA4.1

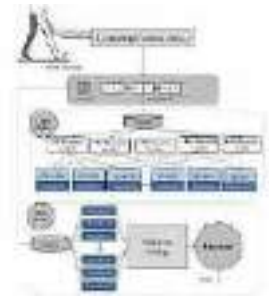
A Multi-Class SVM for Decoding the Human Activity Mode from sEMG Signals

Hadi Kalani[1], S. Mohammad Tahamipour-Z[2], Iman Kardan[2], Alireza Akbarzadeh[2], Amirali Ebrahimi[2], Reza Sede[2]

[1] *Department of Mechanical Engineering, Sadjad University of Technology, Mashhad, Iran*

[2] *Ferdowsi University of Mashhad, Mashhad, Iran*

- This Paper proposes the classification of activity mode of healthy human subjects based on surface Electromyography (sEMG) signals.
- This method provides a reliable solution for the classification of human activity modes, required in many applications like control of exoskeleton robots.



09:50-10:10 92 ThuA4.2

Design and Optimization of a Multi-DOF Hand Exoskeleton for Haptic Applications

Ehsan Amirpour, Mohammad Savabi, Alireza Saboukhi, Masoud Rahimi Gorji, Hamed Ghafarirad, Rasul Fesharakifard, S.Mehdi Rezaei

Amirkabir University of Technology, Tehran, Iran

- This paper describes the design of a novel, underactuated, linkage driven exoskeleton mechanism to provide haptic force feedback for the index and thumb fingers.
- Consequently, the exoskeleton mechanism functionalities within the achieved link length through the optimization procedure are validated, and the design is proposed for further fabrication.

10:10-10:30 96 ThuA4.3

Hand Prosthesis: Finger Localization Based on Forearm Ultrasound Imaging

Amir Samadi[1], Mohammad-Reza Azizi[2], S.Reza Kashef[3], Mohammad-R Akbarzadeh-T[1], Alireza Akbarzadeh-T[3], Ali Moradi[4]

[1] *Center of Excellence on Soft Computing and Intelligent Information Processing, Ferdowsi University of Mashhad, Mashhad, Iran.*

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

[3] *Center of Excellence on Soft Computing and Intelligent Information Processing, Ferdowsi University of Mashhad, Mashhad, Iran.*

[4] *Mashhad University of Medical Sciences, Mashhad, Iran.*

- we designed an end-to-end system for each of four deep convolutional neural networks named VGG-16 and -19, MobileNet V1 and V2.

10:30-10:50 124 ThuA4.4

Designing, Prototyping, and Controlling a Portable Rehabilitation Robot for the Shoulder Physiotherapy and Training

Mohamad ali Soleimani[1], Hassan Zohoor[1], AliReza Fallah yakhdani[1], Mohammad Heravi[1], Esmaeil Mohammadi[1]

[1] *School of Mechanical Eng., Sharif University of Technology, Tehran, Iran*

- In this study, we tried to design, prototype, and control a rehabilitation robot for the shoulder.
- The robot is both convenient and safe to use, such that the patient can make use of it in their houses rather than therapy centers.
- Fed back to the controller, EMG signals are used to determine the intention of the patient.
- The effectiveness of the robot was shown in an experiment was conducted on a male subject, at his house.

The 7th RSI International Conference on
Robotics & Mechatronics

POSTER Presentation

Poster

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

14:30-16:30 | 4 | ThC.1

Agile Multi-Targeting Spacecraft Control Via Backstepping-Sliding mode Approach

Ali Kasiri[1], Farhad Fani saberi[2]
[1] *Faculty of Aerospace Engineering, AMIRKABIR University of Technology, Tehran, Iran*
[2] *Assistant Professor, Faculty Member of Space Sciences and Technology Institute, AMIRKABIR University of Technology, Tehran, Iran*

- This study investigates a hybrid method to improve the conventional backstepping controller.
- an space service micro-spacecraft needs to be agile and maneuverable, so we designed a backstepping-sliding mode controller to reach fast time response.
- we used MATLAB-Simulink simulation environment to analyze the performance of new controller in terms of time response, control effort and robustness.
- simulation results show that backstepping-sliding mode controller has great performance in providing both sudden and slow maneuver.

14:30-16:30 | 34 | ThC.2

Deployment of Model-based Design Approach for a Mini-quadcopter

Amin Talaeizadeh[1], Esmaeil Najafi[2], Hossein Nejat Pishkenari[1], Aria Alasty[1]
[1] *School of Mechanical Engineering, Sharif University of Technology, Tehran, Iran*
[2] *School of Mechanical Engineering, K.N. Toosi University of Technology, Tehran, Iran*

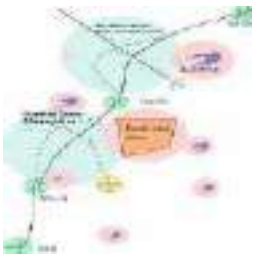
- This paper proposes the implementation of model-based design (MBD) approach for control design of a mini-quadcopter.
- The MBD methodology is utilized to simulate the quadcopter model with aerodynamic effects.
- The experimental result derived from the test flights with harmonic trajectories validates the benefits of using the MBD methodology for control design in quadcopters.

14:30-16:30 | 90 | ThC.3

A hybrid model of path planning for autonomous flying vehicle in urban airspace

Masoud Mirzaei Teshnizi[1], Amirreza Kosari[2]
[1] *Phd Student of New Sciences and Technologies, University of Tehran,Tehran, Iran*
[2] *Faculty of New Sciences and Technologies, University of Tehran,Tehran, Iran*

- This paper presents an operational approach for decentralized agent-based path planning for autonomous flying vehicles.
- In the development of this concept, the direct Radau-pseudospectral method has been employed.
- The nonlinear point mass equations of motion with the realistic operational constraints of the flying vehicle in three-dimensional space are utilized for path planning.



14:30-16:30 | 98 | ThC.4

ARAS-IREF: An Open-Source Low-Cost Framework for Pose Estimation

Hamed Damirchi, Rooholla Khorrambakht, Hamid D. Taghirad
Advanced Robotics and Automated Systems (ARAS) Lab., Faculty of Electrical Engineering, K. N. Toosi University of Technology, Tehran, Iran

- ARAS-IREF is an open source referencing framework for general stationary and mobile robots.
- No well known low-cost robust solutions are available as referencing systems that would allow one to determine the accuracy of developed methods by providing a ground truth for them.
- In this paper an efficient and accurate 6–DoF pose measurement system is proposed and implemented on a spherical parallel robot using IR LEDs.
- Subsequently, custom made testing module is proposed to verify the accuracy of the proposed device.

Poster

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

14:30-16:30 108 ThC.5

Influence of Tilting Rotors on Maneuverability and Agility Indicators of an H-shaped Quadrotor

Yalda Aslani Darandashi[1], Hadi Najd[1], Rasul Fesharakifard[2], Abdolreza Ohadi[1], Hamed Ghafarirad[1]
[1] *Mechanical Engineering Department, Amirkabir University of Technology, Tehran, Iran*
[2] *New Technologies Research Center, Amirkabir University of Technology, Tehran, Iran*

- This article investigates flight functionality indicators for H-shaped quadrotors.
- Two major indicators of flight functionality, in terms of ease of complex motions and response quickness, are maneuverability and agility.
- A comparison between three new selected configurations by the aim of increasing maneuverability and agility around all directions, is performed.

14:30-16:30 123 ThC.6

An Efficient Bio-Inspired Strategy for Motion Control of a Fish Robot to Swim in Different Forward Velocities

Majid Abedinzadeh Shahri, Ali Rouhollahi, Majid Nili Ahmadabadi
ognitive Systems Lab., School of Electrical and Computer Engineering, University of Tehran, Tehran, Iran.

- This paper attempts to find inspiration from nature to propose an energy-efficient motion control strategy for fish robots.
- Here, two phenomena of real fish in swimming are presented to be studied
- To investigate the aforementioned phenomena, an optimization framework in terms of propulsion efficiency is proposed for optimizing flapping motion.

14:30-16:30 44 ThC.7

A Secure Face Anti-spoofing Approach Using Deep Learning

Meysam Safarzadeh, Mohammad Ghasemi, Javad Khoramdel, Ali Najafi Ardekany
Mechatronics Lab., Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran

- This study presents a trusted algorithm to prevent spoof attacks for facial recognition systems.
- Our approach for this security concern, consists of three deep learning-based modules that all of them are CNN-based: Feature classification module, thermal face detection module, and gaze challenge-response module.
- Then, the performance of various network architectures on classifying spoof/real faces and experimental results of each part of the system is discussed.
- Finally, the combination of the best networks formed our robust and secure anti-spoofing approach.

14:30-16:30 16 ThC.8

manufacturing 3D printed industrial robots

Nafise Zamani Moghadam, Anahit Chaychi Salimi
science committe and R&D of qeshmvoltage , Tehran, Iran

- This study investigates the possibility of manufactring robots , specially industrial robots by 3D printers
- there are some benefits which persuade us to make robots by 3Dprinters rather than traditional methodes,for example you can make products by complicated designs by using 3D printers.
- by combining 3D printer and robotics you can make smart factories so that you can make bigger parts with high accuracy.
- Consequently, this methode helps the combination of technology and smart manufacturing.