The 5th RSI International Conference on

Robotics & Mechatronics

ORAL Presentation

Robot Control I

Chairs: Mohammad Reza Hairi-Yazdi, Mohammad Reza Zakerzadeh

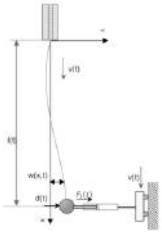
11:00-11:20 | 103 | WeA1.1

Suppressing Transversal Vibration of a Moving String by Back-stepping and Sliding Mode Control Systems

Mohammad Reza Zakerzadeh[1], seyyedSaman Madani[2], Mohsen Bayat[3], Mohammadreza Hairi[4]

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

• In this study we investigate a nonlinear controller to reduce transversal vibration of a moving string.
• The governing equations of the system are derived by Hamiltonian approach and the derived PDEs are discretized by utilizing Galerkin method.
• In this paper two nonlinear controllers based on back-stepping and sliding mode methods are proposed to reduce vibration of the moving string and results are compared.
• Consequently, simulation results indicate that the sliding mode controller outperform the backstepping controller.



11:20-11:40 | 38 | WeA1.2

Combined Direct and Indirect Adaptive Control of Nonlinear Four-bar Linkage Robot Manipulator

Mohammadrasoul Kankashvar, Seyed Kamaleddin Mousavi Mashhadi

Faculty of Electrical Engineering, Iran University of Science and Technology, Tehran, Iran

• In this study, a combined adaptive scheme is applied to nonlinear four-bar linkage robot manipulator using a FPGA.
• The direct and indirect adaptive controllers have their own advantages and disadvantages, which lead to higher tracking errors if implemented separately.
• This paper proposes an adaptive scheme that combines the direct and indirect adaptive controllers into a single new adaptive controller.
• Consequently, simulation results demonstrate the merits of the proposed approach.

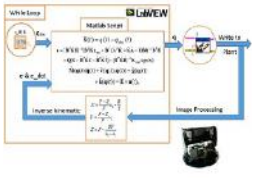
11:40-12:00 | 81 | WeA1.3

Sub-optimal Sliding Mode Control on a Cooperative Manipulator using Stereo Vision Machine Feedback

Amin Habibnejad Korayem, Shahab Kazemi, Saeed Rafee Nekoo

Robotic Research Laboratory, School of Mechanical Engineering, Iran University of Science and Technology (IUST), Tehran, Iran

• In this paper suboptimal sliding mode control method is derived from the common sliding mode control (SMC) via defining the required gains with the state dependent Riccati equation (SDRE) technique, and applied for a class of nonlinear closed-loop systems.
• The stereo vision algorithm is used for measuring the position of the robots end-effector.
• Consequently, Experimental results demonstrate the merits of the proposed approach.



12:00-12:20 | 90 | WeA1.4

An Experimental Study on Controlling and Obstacle Avoidance of a Four Mecanum Wheeled Robot

Parastoo Azizinezhad[1], Rasoul Sadeghian[2], Mehdi Tale Masouleh[3]

[1] *Faculty of Electrical and Computer Science, Robotic Engineering, Tehran North 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 the process of designing a Fuzzy-PID controller and its implementation on a four Mecanum-wheeled robot.

Parallel Robots I

Chairs: Gholamreza Vossoughi, Farzaneh Abdollahi

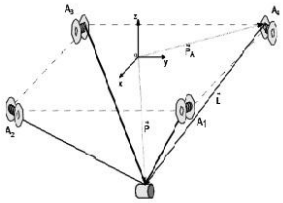
11:00-11:20 30 WeA2.1

Forward Kinematics Resolution of A Deployable Cable Robot

S. Ahmad Khalilpour, Alireza Bourbour, Rohollah Khorrambakht, Salman Kariminasab, Hamid D. Taghirad

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

• In this paper, forward kinematic derivation of a deployable suspended cable robot (DSCR) is investigated.
• Since the positions of the cable attachment points in this robot are not accurately available, the forward kinematics of the robot would not provide an accurate estimate for the end effector position.
• This paper proposes two methods to improve the accuracy of the forward kinematic solutions.
• Consequently, simulation results demonstrate the merits of the proposed approach.



11:20-11:40 74 WeA2.2

Experimental Analysis of an Optimal Redundancy Resolution Scheme in a Cable-Driven Parallel Robot

Masoud Ghanbari[1], Mohammadreza Mousavi[1], S. Ali A. Moosavian[1], Ali Nasr[1], Payam Zarafshan[2]

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

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

• This paper addresses the challenge of redundancy resolution in parallel cable robots.
• The purpose of this work is to propose a method to optimize the force distribution in cables.
• In the proposed method, the null space of structure matrix is mapped into the joint space in such a way that all actuators remain in an optimal compromission of actuator forces.
• Experimental results reveal the merits of proposed algorithm.

11:40-12:00 8 WeA2.3

The effects of joint clearance on the kinematic error of the hexapod tables

Mohammad Javad Tajari[1], Siamak Pedrammehr[2], Mohammad Reza Chalak Qazani[2], Mohammad Javad Nategh[1]

[1] *Faculty of Technology & Eng., Department of Mechanical Engineering, Tarbiat Modares University, Tehran, Iran*

[2] *Institute for Intelligent Systems Research and Innovation, IISRI, Deakin University, VIC, Australia*

• This study investigates the influence of clearance in the spherical joints on the kinematics error.
• A mathematical model between the clearance in the spherical joints on the motion error is derived.
• The positioning error under the spherical joints clearance is obtained by experimental test.

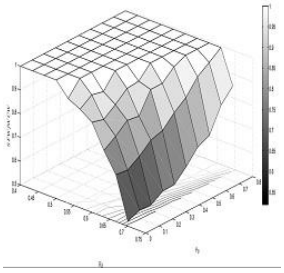
12:00-12:20 83 WeA2.4

Parallel Robots with Application to Optimal Design of a Planar Cable Robot

Javad Bolboli, Mohammad A. Khosravi, Farzaneh Abdollahi

The Center of Excellence on Control and Robotics Department of Electrical Engineering, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran

• In this paper an optimal design of planar cable-driven parallel robot is proposed in which a novel stiffness criterion is used on optimization, so as to allow us to use internal force without any limitation to increase stiffness of the end-effector.
• We obtained a configuration in which both of the controllable and the stiffness-feasible poses are maximum



Serial Robots

Chairs: Mahyar Naraghi, Hamid R. Mohammadi Daniali

11:00-11:20 | 108 | WeA3.1

Dynamic Modeling of Hyper Redundant Manipulator using Ball screw Mechanism Approach

Salar Bayani[1], Rambod Rastegari[2], Farzad Cheraghpour Samavati[3]

[1] *Mechatronics Research Laboratory, Department of Computer Engineering, Qazvin Branch, Islamic Azad University, Qazvin, Iran*

[2] *Department of Mechanical Engineering, Parand Branch, Islamic Azad University, Tehran, Iran*

[3] *Department of Mechanical Engineering, Pardis Branch, Islamic Azad University, Tehran, Iran*

• In this article the dynamic modeling of novel model of hyper redundant robot has been studied.
• The stiffness and reliability of the mechanism increased due to combination of serial base and parallel structured actuators.

11:20-11:40 | 168 | WeA3.2

Online Adjustment of Parameters and Controller of Reconfigurable Robots: Online Lyaponuv Equation Solution Approach

Mojtaba Moradi, Mahyar Naraghi, Ali K. Eigoli

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

• This study investigates optimal control of serial robotic manipulators and the main concern is to adjust parameter in online.
• A continuous-time framework an online approach to direct adaptive optimal co-design of plant and controller for open chain reconfigurable robots is proposed
• The study implemented in a Two link manipulator with adjustable counterweights.
• Consequently, Experimental results demonstrate the merits of the proposed approach.

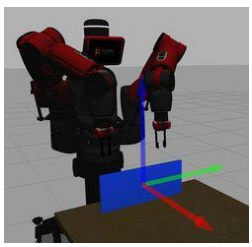
11:40-12:00 | 35 | WeA3.3

Grasp that optimises objectives along post-grasp trajectories

Amir Masoud Ghalamzan Esfahani, Nikos Mavrakis, Rustam Stolkin

Extreme Robotics Lab (ERL)., School of Metallurgy and Materials, University of Birmingham, Birmingham, United Kingdom

• This study investigates the influence of different objectives important to post-grasp manipulative actions on the selecting the best grasping pose.
• The cost functions proposed in the previous works have been computed for different test cases.
• The results show that the objectives conflict.
• Consequently, this study suggests that for selecting the best grasping pose according to the presented objective functions a multi-objective optimisation problem must be solved in a future work.



12:00-12:20 | 71 | WeA3.4

Theoretical and experimental dynamic evaluations of revolute-prismatic joints manipulator contains N- rigid links and hubs

Pedram Monfared, Morteza Mojaradi, Siavash Fathollahi Dehkordi

School of Mechanical Engineering, Iran University of Science and Technology (IUST), 1684613114, Tehran, Iran

• in this paper, a rigid manipulator composed of revoluteprismatic joints has been designed and modeled by recursive GibbsAppell formulation.
• the model simulated in SimMechanics software and experimental result extracted to weighting the mathematical model results evaluates by Matlab software precisions.

Medical Robots I

Chairs: Aria Alasty, Ali Nahvi

11:00-11:20 147 WeA4.1

The Effects of Drowsiness on Blinking Pattern in Sleep Apnea and Narcolepsy Disorders and for Normal Participants

Mohammad Mahmoodi, Mohammadali Rastin, Sara Hooshmand, Ali Nahvi

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

• The focus of this study is to measure the ability of individuals to maintain alert in a standard test. Maintenance of Wakefulness Test.
• To assess the alertness of participants, the standard Observer Rating of Drowsiness (ORD) criterion has been employed.
• The main objective is to find a relationship between features extracted from the EOG signal and the sleepiness assessment criterion ORD.
• In this regard, the ability of 21 normal people without any sleep disorder and 8 people suffering from sleep Apnea and Narcolepsy were tested.

11:20-11:40 102 WeA4.2

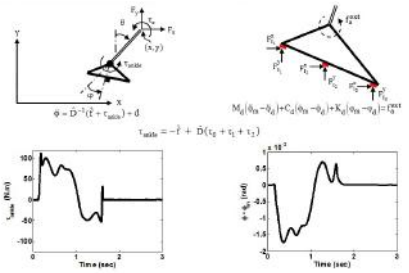
A Novel Stable Robust Adaptive Impedance Control Scheme for Ankle Prostheses

Siamak Heidarzadeh[1], Mojtaba Sharifi[2], Hassan Salarieh[1], Aria Alasty[1]

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

[2] *Department of Mechanical Engineering, Shiraz University, Shiraz, Iran*

• A novel low-level robust adaptive impedance control strategy is introduced for active ankle prostheses.
• The exponential stability of the developed controller is proven using a Lyapunov stability analysis.
• Simulation results demonstrate the applicability of the proposed low-level control scheme.



11:40-12:00 14 WeA4.3

Design and implementation of a new body weight support (BWS) system

Mahdi Hamidi Rad, Saeed Behzadipour

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

• A new over-ground body weight support is introduced in this article. The system is composed of two main modules namely unloading and traction.
• The unloading module is capable of suspending an individuals weight up to 1000N dynamically.
• The performance of both modules is controlled by an error-based closed loop controller and the results are evaluated in different working conditions.
• This system is able to keep the average root-mean-square of the unloading force error within 10% of its desired amount and to maintain the rope angle in the range of 4 to 7 degrees by the traction motor.

12:00-12:20 178 WeA4.4

Design and Implementation of a Cable Driven Lower Limb Exoskeleton for Stair Climbing

Payman Joudzaadeh, Alireza Hadi, Khalil Alipour, Bahram Tarvirdizadeh

Advanced Service Robots (ASR) Laboratory., Department of Mechatronics Engineering, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran

• This study presents a novel design for a lower limb exoskeleton to assist user in stair climbing.
• It features cable driven mechanism to make it lighter and more wearable.
• Results show that the proposed mechanism is usable and has an acceptable performance.

Socical Robotics

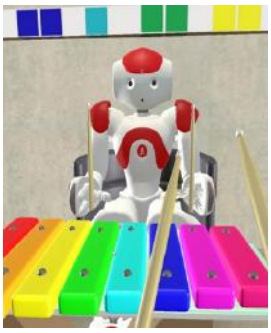
Chairs: Ali Meghdari, Minoo Alemi

11:00-11:20 47 WeA5.1

Social Virtual Reality Robot (V2R): A Novel Concept for Education and Rehabilitation of Children with Autism

Mojtaba Shahab[1], Alireza Taheri[1], Seyed Ramezan Hosseini[1], Mohammad Mokhtari[1], Ali Meghdari[1], Minoo Alemi[2], Hamidreza Pouretemad[3], Azadeh Shariati[4], Ali Ghorbandaei Pour[1]
[1] *Social & Cognitive Robotics Laboratory, Sharif University of Technology, Tehran, Iran*
[2] *Islamic Azad University, Tehran-West Branch*
[3] *Institute for Cognitive and Brain Sciences, Shahid Beheshti University, Tehran, Iran*
[4] *Islamic Azad University, Tehran-North Branch*

• In this paper, we have introduced a novel application Social Virtual Reality Robots for music education and rehabilitation of children with autism.



11:20-11:40 48 WeA5.2

Xylotism: A Tablet-Based Application to Teach Music to Children with Autism

Seyed Jamaladin Haddadi[1], Payam Zarafshan[2], Maysam Shahsavari[2]
[1] *Department of Electrical, Computer and IT Engineering, Qazvin Islamic Azad University, Qazvin, Iran*
[2] *Department of Agro-Technology, College of Aburaihan, University of Tehran, Pakdasht, Tehran, Iran*

• Major aim of this brief is attitude and altitude control of a Quadrotor using second order Sliding Mode Control (2O-SMC).
• controller is derived using Lyapunov stability and asymptotically stability has been theoretically proved.
• The controller ensures that all the system states trajectories reach to sliding surfaces and will stay on them.
• effectiveness and robustness of this controller has demonstrated in simulation results.

11:40-12:00 9 WeA5.3

How to Develop Learners Politeness: A Study of RALLs Impact on Learning Greeting by Young Iranian EFL Learners

Minoo Alemi[1], Nafiseh Sadat Haeri[2]
[1] *Department of Humanities, West Tehran Branch, Islamic Azad University, Tehran, Iran*
[2] *Languages and Linguistics Center, Sharif University of Technology, Tehran, Iran*

• This study explores the effect of RALL on instructing greeting to young EFL students in Tehran, Iran.
• The overall conclusion of this study was that a robot can provide a helpful and enjoyable experience for any child and it can be used in many contexts provided psychological and safty conditions are considered in advance.

Robot Control II

Chairs: Heydar Ali Talebi, Mohammadreza Homaeinezhad

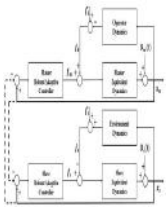
14:30-14:50 120 WeB1.1

Robust Adaptive Bilateral Control of Teleoperation Systems with Uncertain Parameters and Unmodeled Dynamics

Mojtaba Esfandiari, Kianoosh Nazari, Farzam Farahmand

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

• In this paper, a robust adaptive master-slave teleoperation control strategy is introduced which requires neither the exact knowledge
• equation of master/slave Falcon robot, because of the robustness against the unmodeled dynamics.Two Novint Falcon robots are used as master/slave robots and due to having the highly nonlinear complexity of these robots.
• A Lyapunov function is introduced for stability and the position tracking convergence proof of the entire teleoperation system. The validity of the theory is confirmed by simulations.



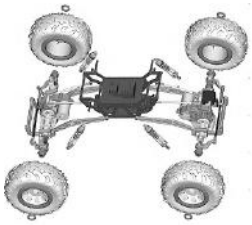
14:50-15:10 152 WeB1.2

Development of a leader-follower formation control algorithm in absence of followers position and velocity information

Atefeh Sahraeekhanghah, Mohammadreza Homaeinezhad

Mechatronic Mechanism Laboratory (MML)., Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran

• This paper introduces a new multi-agent control algorithm for a network consisted of a leader and a number of follower which lack linear behavior sensors.
• The algorithm uses the angular behavior sensors to estimate the followers position.
• Simulation and test results show significant improvement compared to conventional algorithms and the error growth rate has almost decreased to zero.



15:10-15:30 153 WeB1.3

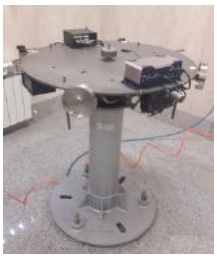
Attitude Control of Spacecraft Simulator with Reaction Wheels Regulation

Maryam Malekzadeh[1], Hamid Sadeghian[2]

[1] *Department of Mechanical Engineering, University of Isfahan, Isfahan, Iran*

[2] *Engineering Department, University of Isfahan, Isfahan, Iran*

• In this paper the attitude control of a spacecraft simulator using Reaction Wheels (RW) as the actuators is investigated.
• The main goal is to bring the RWs to the rest at the end of the maneuver without any extra actuators.
• The stability of the proposed controller is analyzed using Lyapunov stability approach.
• The algorithm is evaluated numerically and experimentally on an attitude spacecraft simulator.



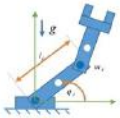
15:30-15:50 156 WeB1.4

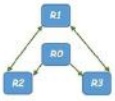
Adaptive Synchronization Control of Multiple Robotic Manipulators: Dynamic Surface Control Approach

Maedeh Taj, Maryam Shahriari-Kahkeshi

Faculty of Engineering, Shahrekord University, Shahrekord, Iran

• An adaptive synchronization control for a class of Euler-Lagrange multiple robotic manipulators has been desgined.
• The proposed distributed dynamic surface control approach avoids the explosion of complexity problem.
• The synchronization error converges to a small neighborhood of the origin by appropriate selection of the design parameters.





Robot Control II

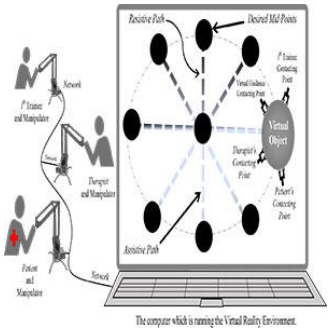
Chairs: Heydar Ali Talebi, Mohammadreza Homaeinezhad

15:50-16:10 180 WeB1.5

Haptic Tele-cooperation of Multiple Robots

Iman Sharifi[1], Heidar Ali Talebi[1], Ali Nasr[1], Mahdi Tavakoli[2]
[1] *Amirkabir University of Technology, Tehran, Iran*
[2] *Department of Electrical and Computer Engineering, University of Alberta, Edmonton, AB T6G 1H9, Canada.*

- A novel haptic tele-cooperation control scheme.
- A system consisting of multiple manipulators interacting with a physical or virtual object is proposed.
- The Lyapunovs method is used for designing and analysis of stability in this paper.



Legged Robots

Chairs: S. Ali A. Moosavian, Aghil Yousefi-Koma

14:30-14:50 110 WeB2.1

Pattern Generation for Walking on Slippery Terrains

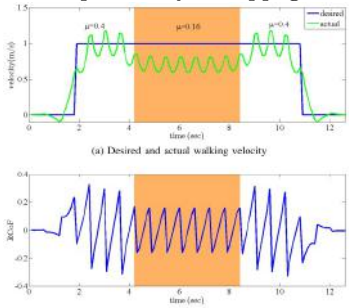
Majid Khadiv[1,2], S. Ali A. Moosavian[1], Alexander Herzog[2], Ludovic Righetti[3]

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

[2] *Autonomous Motion Department, Max-Planck Institute for Intelligent Systems, Germany*

[3] *Department of Mechanical and Aerospace Engineering, Department of Electrical and, Computer Engineering, New York University, USA*

• In this paper, we extend state of the art Model Predictive Control (MPC) approaches to generate safe bipedal walking on slippery surfaces.
• Simulation results show that increasing the walking velocity increases the possibility of slippage.



(a) Desired and actual walking velocity

(b) Required Coefficient of Friction (RCoF)

14:50-15:10 140 WeB2.2

Push Recovery of a Position-Controlled Humanoid Robot Based on Capture Point Feedback Control

Milad Shafiee[1], Aghil Yousefi-Koma[1], Reihaneh Mirjalili[1], Hessam Maleki[1], Mojtaba Karimi[2]

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

[2] *Technical University of Munich, Germany*

• In this paper, a combination of ankle and hip strategy is used for push recovery of a position-controlled humanoid robot.
• we present an efficient way to implement the hip and ankle strategies on a position controlled humanoid robot.
• Experimental implementation on SURENA-Mini humanoid robot demonstrate the merits of the proposed approach.

15:10-15:30 150 WeB2.3

Design and Implementation of Small-sized 3D Printed Surena-Mini Humanoid Platform

Arman Nikkhah, Aghil Yousefi-Koma, Reihaneh Mirjalili, Hossein Morvaridi Farimani

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

• This paper describes the design and implementation of a small-sized 3D printed humanoid robotic platform.
• Surena-Mini is the first small-sized humanoid robot which is fabricated completely with 3D printing technology.
• Because of the flexibility of 3D printing technology, Surena-Mini can be assigned with both human proportions and aesthetic appeals.

15:30-15:50 87 WeB2.4

Balance Strategy for Human Imitation by a NAO Humanoid Robot

Pourya Shahverdi[1], Mohammad Javad Ansari[2], Mehdi Tale Masouleh[3]

[1] *Department of Electrical, Biomedical and Mechatronics Engineering, Qazvin Branch, Islamic Azad University, Qazvin, Iran.*

[2] *Faculty of Compuer Science and Engineering, Shahid Beheshti University, Tehran, Iran.*

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

• This paper presents an ankle-based balance strategy for a NAO humanoid robot while imitating the human motions.

Legged Robots

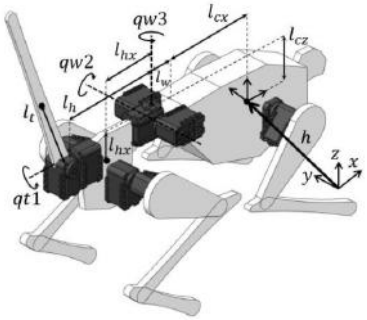
Chairs: S. Ali A. Moosavian, Aghil Yousefi-Koma

15:50-16:10 37 WeB2.5

Robot Cat Free Fall: Bio-Inspired Adaptive Motor Control with Differential Forward Kinematic Model

S.M.Hadi Sadati[1], Ali Meghdari[2], S. Elnaz Naghibi[3]
[1] *Center for Robotics Research (CoRe), Department of Informatics, Kings College London, London*
[2] *Center of Excellence in Design, Robotics and Automation (CEDRA), Department of Mechanical Engineering, Sharif University of Technology*
[3] *School of Engineering and Material Science, Queen Mary, University of London*

- A bio-inspired adaptive motor control is introduced
- The method performance is investigated numerically.
- These results help to build a robot cat prototype in near future.



Mechatronics

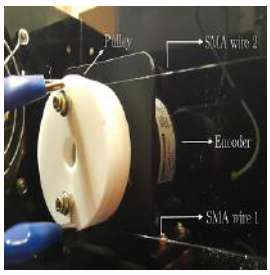
Chairs: Amir Hossein Davaei Markazi, Payam Zarafshan

14:30-14:50 | 10 | WeB3.1

An experimental study on controlling a fast response SMA-actuated rotary actuator

Azadeh Doroudchi[1], Mohammad Reza Zakerzadeh[2]
[1] *Mechatronics Engineering Group, Alborz Campus, University of Tehran*
[2] *School of Mechanical Engineering, College of Engineering, University of Tehran*

• In this paper a rotary actuator actuated by a pair of antagonistic SMA wires is controlled for trajectory tracking purposes.
• The results indicate that the rotary actuator controlled via PID method is able to track the reference inputs accurately even in high frequency bandwidth.
• Achieving 5 Hz working frequency is a big step in improving the speed of SMA-actuated systems.

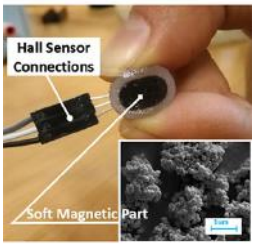


14:50-15:10 | 39 | WeB3.2

A New Soft Force Sensor using Blended Silicone-Magnetic Powder

Hossein Mirzanejad[1], Mohammad Mojarrabi Tabrizi[1], Ashkan Fathian[1], Ali Sharifnejad[2], Mahdi Agheli[1]
[1] *Legged and Soft Robotics (LSR) Lab., Mechanical Engineering Department, Tarbiat Modares University, Tehran, Iran*
[2] *Sport Science Research Institute, Tehran, Iran*

• This study introduces a new soft magnetic force sensor usable in the field of soft robotics, foot force mapping, etc.
• This paper proposes a novel approach to replace the rigid magnets with fully soft magnetic powder blended with elastomer membrane.
• According to the experimental results, the developed thin soft force sensor can be used to measure a wide range of normal forces, which makes it suitable for a variety of relevant applications.

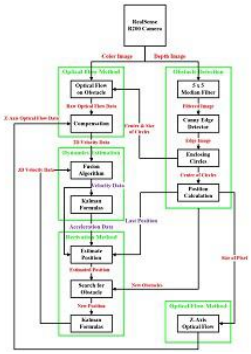


15:10-15:30 | 65 | WeB3.3

Estimation of Moving Obstacle Dynamics with Mobile RGB-D Camera

Saeed Bakhshi Germi[1], Alireza Zamanian[1], Mojtaba Ahangar Arzati[2], Mohammad A. Khosravi[3], Rasul Fesharakifard[4]
[1] *Robotics Research Center,s Amirkabir University of Technology, Tehran, Iran*
[2] *Department of Electrical Engineering, K. N. Toosi University of Technology, Tehran, Iran*
[3] *Department of Electrical Engineering, Amirkabir University of Technology, Tehran, Iran*
[4] *New Technologies Research Center, Amirkabir University of Technology, Tehran, Iran*

• This paper presents an algorithm that calculates the position and dynamics of moving obstacles.

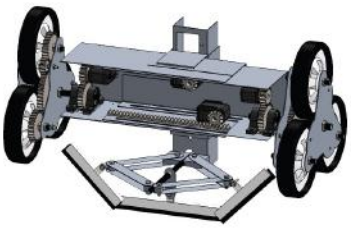


15:30-15:50 | 80 | WeB3.4

Design and Analysis of a Dredger Robot for Covered Irrigation Canals

Sh. Shademani[1], Payam Zarafshan[1], M. Khashehchi[1], M. H. Kianmehr[1], S. M. Hashemy[2]
[1] *Department of Agro-Technology, College of Aburaihan, University of Tehran, Pakdasht, Tehran, Iran*
[2] *Department of Irrigation and Drainage Engineering, College of Aburaihan, University of Tehran, Pakdasht, Tehran, Iran*

• A robotic system for dredging the irrigation canal was proposed in this paper
• Design, modeling and simulation study of a dredger robot was presented
• Simulations had been conducted for three modes: coming down the stair, crossing the obstacle and climbing the stair.
• The robot had the most stable mode whereas it comes down the stairs.



Mechatronics

Chairs: Amir Hossein Davaei Markazi, Payam Zarafshan

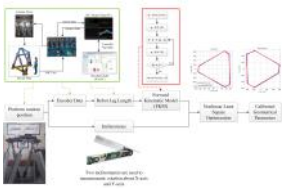
15:50-16:10 7 WeB3.5

Calibration of Stewart-Gough Parallel Robot with Minimum Sensor and Position Control in Joint Space

Hamed Navvabi, Behnam Hosseinkhani, Farbod Shokouhi, Amir Hossein Davaei Markazi

Digital Control Lab., Faculty of Mechanical Engineering, Iran University of Science and Technology, Tehran, Iran

• This paper focuses on the accuracy enhancement of a 6-DOF SGP robot through kinematic calibration.
• In this method minimum number of sensors (two inclinometers) have been used for SGP kinematic calibration.
• The robot position is controlled in the joint space; experimental results show that calibrated robot follows command signal more accurate than before the calibration.



Medical Robots II

Chairs: M. Zareinejad, Khalil Alipour

14:30-14:50 28 WeB4.1

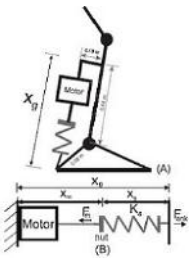
Impact of Electro-mechanical Properties of the Actuation Mechanism on the Peak Power and Energy Requirements of Active Foot Prostheses

Mahdy Eslamy, Khalil Alipour

Department of Mechatronics Eng., Faculty of New Sciences and Technologies, University of Tehran

• In this study, we investigate on the peak power and energy requirements of the active foot prostheses when the electro-mechanical parameters of the actuation mechanism are taken into account.

• Furthermore, it is found that, although these parameters can change the power and energy requirements drastically, they do not necessarily result in the deviation of the optimal system stiffness from the ideal value.



14:50-15:10 50 WeB4.2

Multi-lateral Nonlinear Time-Delayed Teleoperation in a Multi-agent Systems Framework

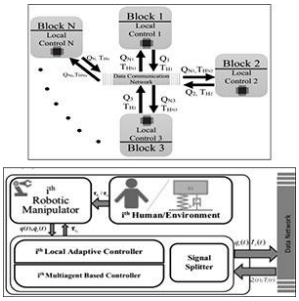
Iman Sharifi[1], Heidar Ali Talebi[1], Ali Nasr[1], Mahdi Tavakoli[2]

[1] *Amirkabir University of Technology, Tehran, Iran*

[2] *Department of Electrical and Computer Engineering, University of Alberta, Edmonton, AB T6G 1H9, Canada.*

• The multi-agent system (MAS) based structure is presented to solve the problem of multi-lateral non-linear teleoperation.

• This paper introduces a framework for simultaneous training and therapy in multi-lateral tele-rehabilitation systems.



15:10-15:30 55 WeB4.3

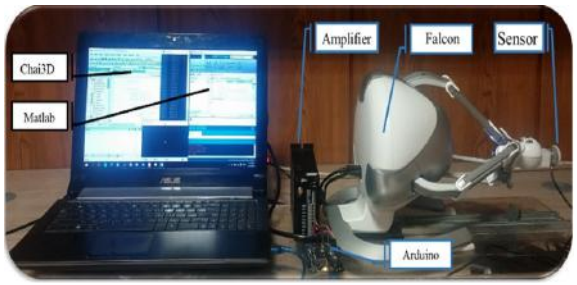
Dynamic Characterization of a Parallel Haptic Device for Application as an Actuator in a Surgery Simulator

Farshad Khadivar, Soroush Sadeghnejad, Hamed Moradi, Gholamreza Vossoughi, Farzam Farahmand

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

• In this research, we have implemented the Lion identification method to characterize the dynamics of a parallel haptic device in actuating a surgery simulation.

• The results reveal that the system parameters converge to the specific values while the output tracking error and its derivative behavior is reasonable, that is, the system identification is of great accuracy.



15:30-15:50 68 WeB4.4

An Observer-based Force Reflection Robust Control for Dual User Haptic Surgical Training System

Mohammad Motaharifar, Hamid D. Taghirad

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

• This note investigates the controller design problem for the dual user haptic surgical training system in which the trainer and the trainee collaboratively perform a surgical operation.

• The position of the trainee and the contact force with the environment are sent to the trainer to give him necessary information regarding the status of surgical operations.

• Based on the robust control approach, stabilizing control laws are designed for each haptic device and the stability of the closed-loop system is investigated using the ISS stability theorem.

Medical Robots II

Chairs: M. Zareinejad, Khalil Alipour

15:50-16:10 34 WeB4.5

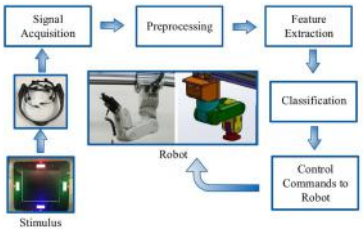
Brain Computer Interface Control of a Virtual Robotic System based on SSVEP and EEG Signal

Fatemeh Akrami, Ebrahim Abedloo, Hamid D. Taghirad

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

• In this paper a complete online integrated BCI system comprising of a virtual industrial robotic manipulator, an EEG deployment and statistical feature extraction method is developed and real time experiments to verify its accuracy and effectiveness is experimented on different subjects.

• Consequently, the experiments shows the promising features of the developed systems for further applications.



Robot Control III

Chairs: Hamid Taghirad, Farid Najafi

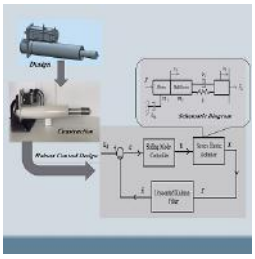
8:30-8:50 | 44 | ThA1.1

A New Scheme for Robust Control of Uncertain Series elastic actuator System

Seyed Ali Moafi, Farid Najafi

Department of Mechanical Eng., University of Guilan, Rasht, Iran

• The approach of this study is to improve the efficiency of uncertain SEAs in control engineering aspects.
• A robust control design including combination of unscented Kalman filter and sliding mode control is developed for linear force-controlled SEA system.
• The work in this paper focuses on improving the performance of SEA system in the presence of uncertainties.
• Finally, simulation results are provided to demonstrate the effectiveness of the proposed control design.



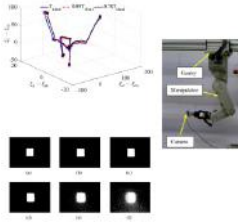
8:50-9:10 | 6 | ThA1.2

A Robust Approach Toward Kernel-Based Visual Servoing

Mahsa Parsapour, Hamid D. Taghirad

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

• This work introduces a robust controller for kernel-based visual servoing systems.
• In vision-based systems, image uncertainties affect the tracking performance and stability, and the target object may get out of the field of view.
• The effect of the image noise has been investigated as the main source of uncertainty, and its characteristics has been encapsulated in a proper representation.
• An application of the proposed method is experimentally tested on an industrial robot.

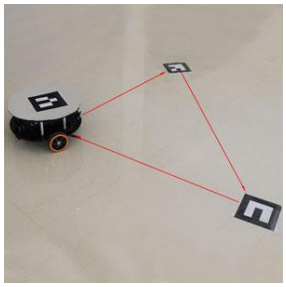


9:10-9:30 | 84 | ThA1.3

Mobile robot navigation based on Fuzzy Cognitive Map optimized with Grey Wolf Optimization Algorithm used in Augmented Reality

Ehsan Malayjerdi[1], Mahdi Yaghoobi[1], Mohammad Kardan[2]
[1] *Department of Artificial intelligence Islamic Azad University Mashhad Branch, Mashhad, Iran*
[2] *Department of Computer science, Khayyam University, Mashhad, Iran*

• this work presents a control technique for Mobile Robot Navigation using augmented reality (AR).
• practical experiment reveals that Augmented reality, such as the Glyphs and a simplified map, are an effective tool for mobile robots to use in navigation in unknown environments.



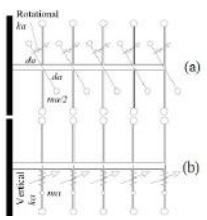
9:30-9:50 | 98 | ThA1.4

Adaptive Control for Reducing Nonlinear Vibrations of a Flexible Arm

Hossein Mohammadi, Soheil Salighe

Department of Mechanical Engineering, Shiraz University, Shiraz, Iran

• This study developes a Virtual Absorber for suppressing the vertical and rotational vibration of a nonlinear lumped-mass flexible arm.
• An adaptive control algorithm is employed to attenuate the oscillations of the lumped-mass flexible arm on which harmonic excitations with time varying frequency are imposed.
• The linear and nonlinear stiffness of the main system are obtained using finite element method.
• Regardless of the main system uncertainties, the results indicate successful performance in nullifying the main system vibrations.



Parallel Robots II

Chairs: Mehdi Tale Masouleh, Adrian Olaru

8:30-8:50 | 135 | ThA2.1

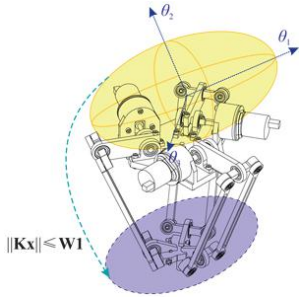
Kinematic Sensitivity Evaluation of Revolute and Prismatic 3-DOF Delta Robots

Behzad Mehrafrooz[1], Mohsen Mohammadi[1], Mehdi Tale Masouleh[2]

[1] *Human and Robot Interaction Lab., University of Tehran, Tehran, Iran*

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

• This study investigates the kinematic performance of two types of 3-DOF Delta Robot namely, revolute-input and prismatic-input.
• This paper employs an optimization method based on the kinematic sensitivity indices to redesign the configuration the two robots.



8:50-9:10 | 23 | ThA2.2

Dynamic Modeling and Base Inertial Parameters Determination of 3-DoF Planar Parallel Manipulator

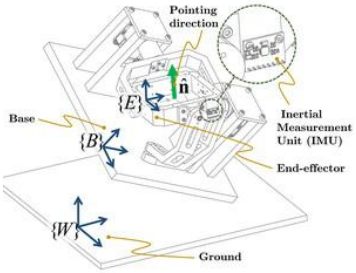
Alaleh Arian[1], Behzad Danaei[1], MohammadReza Alipour[2], Mehdi Tale Masouleh[3], Ahmad Kalhor[3]

[1] *Human and Robot Interaction Laboratory, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran*

[2] *Human and Robot Interaction Laboratory, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran*

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

• The objective of this research is to present a 2-DoF gimbal system with parallel kinematic chain for the first time.



9:10-9:30 | 5 | ThA2.3

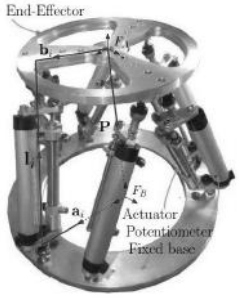
An Experimental Study on Control of a Pneumatic 6-DoF Gough-Stewart Robot Using Backstepping-Sliding Mode and Geometry-Based Quasi-Forward Kinematic Method

Amir Salimi Lafmejani[1], Behzad Danaei[1], Ahmad Kalhor[2], Mehdi Tale Masouleh[2]

[1] *Faculty of New Sciences and Technologies, Human and Robot Interaction Laboratory, University of Tehran*

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

• This paper focuses on an experimental in trajectory tracking and kinematic control of a pneumatically actuated 6-DoF Gough-Stewart parallel robot.



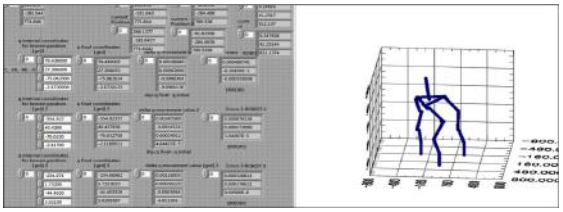
9:30-9:50 | 2 | ThA2.4

Modeling and simulation of the parallel robot's structure with LabVIEWTM instrumentation

Adrian Olaru, Serban Olaru, Niculae Rafee Nekoo

University Politehnica of Bucharest, Bucharest, Romania

• In this paper, a complex matrix method to solve the Forward Kinematics (FK) is established.
• By using data acqusition board and didactial arm type robot was possible to check the proposed matrix model of the robot kinematics.
• The proposed method, the algorithm and the LabVIEWTM VI-s can be applied in many other application of the complex open and closed robot structures.



Wheeled Mobile Robots

Chairs: Ahmad Bagheri, Alireza B. Novinzadeh

8:30-8:50 170 ThA3.1

Design and Prototyping A New Add-On Module to Increase Traction Force of A Wheeled Sewer Inspection Robot

Alireza Hadi, Morteza Abdollahi, Khalil Alipour, Bahram Tarvirdizadeh

Advanced Service Robots (ASR) Laboratory, Department of Mechatronics Engineering, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran

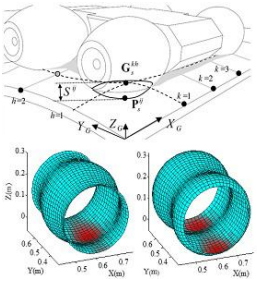
• This study presents a novel add-on module to increase the robot traction when encounter obstacles.
• The mechanism consists of two links mounted beside the robot and able to eigther rotate or change the length.
• The designed system is evaluated through simulations and experiments.
• Results show that the mechanism is usable with an acceptable performance.

8:50-9:10 19 ThA3.2

Terramechanics-based performance enhancement of the wide robotic wheel on the soft terrains, Part I: wheel shape optimization

Saeed Ebrahimi[1], Arman Mardani[2]
[1] *Department of Mechanical Engineering Yazd University Yazd-Iran*
[2] *Department of Mechanical Engineering Yazd University Yazd-Iran*

• This study optimizes the shape of the wheel interacting with soil and soft surfaces.
• The first part of this paper presents an approach for characterization of the essential terramechanic and dynamic parameters of the wide robotic wheels moving on soft soil using the soil contact model (SCM) method.

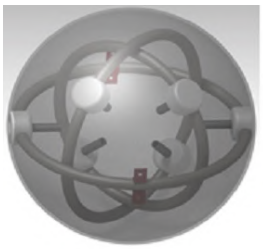


9:10-9:30 173 ThA3.3

Modeling and Simulation of a Novel Hydralic Spherical Rolling Robot Using Bondgraph Approach

Roya Khajepour[1], Alireza Basohbat Novinzadeh[2]
[1] *Advanced Robotics and Automated Systems (ARAS) Lab., Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran*
[2] *Department of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran*

• This paper aims at modeling of a novel spherical robot with hydraulic internal mechanism using bond graph approach.
• In addition, The Newton-Euler formalism is exploited to model the dynamics of the proposed spherical robot.
• Consequently, Simulation results are pinpointed for equal inputs in open-loop physical model.

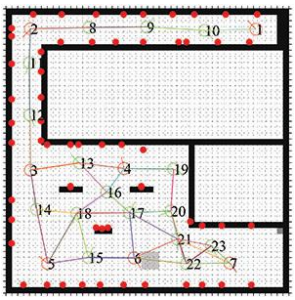


9:30-9:50 27 ThA3.4

Implementation of Multi-Goal Motion Planning Under Uncertainty on a Mobile Robot

Ali Noormohammadi Asl[1], Hamid D. Taghirad[1], Amirhossein Tamjidi[2]
[1] *Advanced Robotics and Automated Systems (ARAS) Lab., Faculty of Electrical Engineering, K. N. Toosi University of Technology, Tehran, Iran*
[2] *Department of Aerospace Engineering, Texas A&M University*

• This paper addresses the problem of multi-goal motion planning under uncertainty using TSP.
• Finally, the algorithms are implemented on a nonholonomic mobile robot in a real environment where the robot faces a plethora of problems such as kidnapping and environment changes.



Aerial and Underwater Robots

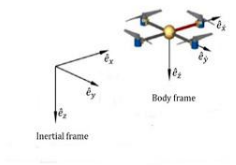
Chairs: Mohammad Bozorg, Mohammad A. Khosravi

8:30-8:50 | 165 | .1

Updating LQR Control for Full Dynamic of a Quadrotor

Ramin Afhami[1], Rasul Fesharakifard[2], Mohammad A. Khosravi[3]
[1] *Robotics Research Center, Amirkabir University of Technology, Tehran, Iran*
[2] *New Technologies Research Center, Amirkabir University of Technology, Tehran, Iran*
[3] *Department of Electrical Engineering, Amirkabir University of Technology, Tehran, Iran*

• This study provides a complete governing quadrotor dynamic equation system using the Euler-Lagrange method considering all aerodynamic forces.
• This paper proposes a new control method, Updating LQR control for dynamic equations.
• Consequently, In both examples successful trajectory and altitude control are achieved.



8:50-9:10 | 79 | .2

Backstepping-Sliding mode Control Performance Enhancement using Close Loop Identification for Quadrotor Trajectory Tracking

Ashkan Parsa[1], Mohammadali Amiri Atashgah[1], Ahmad Kalhor[2]
[1] *Aerospace Enginnering, Department of New Science and Technologies, University of Tehran, Tehran, Iran*
[2] *College of Engineerng, School of Electrical and Computer Engineering, University of Tehran, Tehran, Iran*

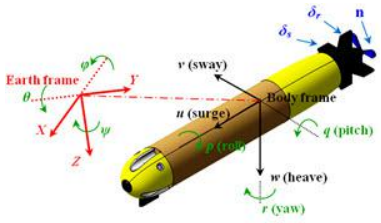
• In this study, backstepping- sliding mode control method was used in a quadrotor in order to track a desired path.

9:10-9:30 | 1 | .3

Finitary Optimal Gain for Diving Control of AUVs via Input-state Linearization

Shahab Kazemi, Behdad Geranmehr, Saeed Rafee Nekoo
School of Mechanical Engineering, Iran University of Science and Technology (IUST)

• Finite time control design of an autonomous underwater vehicle (AUV) in presence of known disturbance and uncertainty is investigated in this work.
• finitary gain of input-state feedback linearization control under actuator saturation constraint is presented.
• The capability of the proposed method was confirmed by outstanding results of simulation.



9:30-9:50 | 104 | .4

Tracking Control of an Underwater Robot in the Presence of Obstacles

S. Ali A. Moosavian[1], Ali Keymasi Khalaji[2], Fahimeh S. Tabatabai-Nasab[1]
[1] *Advanced Robotics and Automated Systems (ARAS) Lab., Faculty of Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran*
[2] *Department of Mechanical Engineering, Kharazmi University , Tehran, Iran*

• The aim of this research is to develop a robust control law to avoid obstacles intersecting the desired path.
• Potential function based sliding mode control laws are developed to guide the motion of the underwater robot in an environment containing obstacles.
• The control law proposed is evaluated for different case studies in order to investigate systems stability and performance.