The 2nd RSI International Conference on

Robotics & Mechatronics

ORAL Presentation

Control I

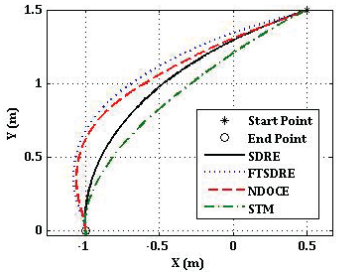
Chairs: Moharam Habibnejad Korayem, Iran University of Science & Technology
Mohammad Mahjoob, University of Tehran

11:00-11:20 20 WeA1.1

Nonlinear Optimal Control via Finite Time Horizon State-dependent Riccati Equation

Moharam Habibnejad Korayem, Saeed Rafee Nekoo
Robotic Research Laboratory, School of Mechanical Engineering, IUST

• This paper presents the finite time horizon state-dependent Riccati equation.
• The systems with control and state nonlinearities and time-varying parameters are considered.
• The application of the proposed method is shown for robotic arms.

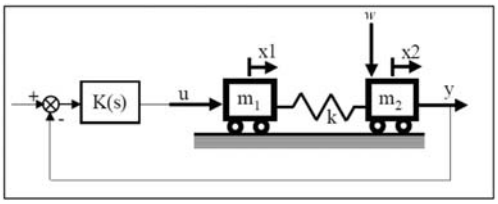


11:20-11:40 46 WeA1.2

Automated Synthesis of Optimal Controller Using Multi-Objective Genetic Programming For Two-Mass-Spring System

Iman Gholaminezhad, Ali Jamali, Hirad Assimi
University of Guilan

• Multi-objective uniform-diversity genetic programming (MUGP) is used for automated synthesis of both structure and parameter tuning of optimal controllers.
• Each candidate controller illustrated by a transfer function, whose optimal structure and parameters, obtained based on performance optimization of each candidate controller.
• The performance indices (e.g. ITAE, control effort, stability, overshoot, settling time, rise time) of each controller which are obtained based on open loop and closed loop control system simulation are treated as separate objective functions for the two-mass-spring system.

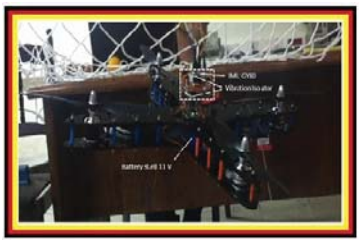


11:40-12:00 89 WeA1.3

Attitude Control Using an Extended Calssifier System Algorithm for Offline Auto-Tuning of a PID Controller

Ehsan Abbasi, Mohammad Mahjoob, Ali Shafiekhani
School of mechanical engineering, University of Tehran

• Stabilizing control and guidance of the quadrotor is a difficult task because of the nonlinear dynamic behavior.
• This paper will be presented a new PID tuning method based on artificial intelligence. XCS (eXtended Classifier System) approach is used to adjust the PID parameters.
• The XCS is a rule-based system in which each rule has a condition, action and set of parameters and use reinforcement learning and genetic algorithm and etc.



12:00-12:20 157 WeA1.4

Chaotic Anti-Control of a Rotary Gantry System via Variable Structure Rule-Based Fuzzy Control

Legged Robotics I

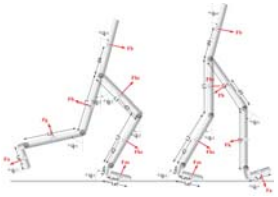
Chairs: Gholamreza Vossoughi, Sharif University of Technology
Mohammad Jafar Sadigh, Isfahan University of Technology

11:00-11:20 130 WeA2.1

A Fast Kinematic-Based Control Method for Lower-limb Power Augmentation Exoskeleton

Ali Taherifar[1], Gholam Reza Vossoughi[1], Ali Selk Ghafari[2], Mehdi Jokar[3]
[1]Mechanical Department of Sharif University of Technology
[2]School of Science and Engineering of Sharif University of Technology
[3]Mechanical Department of Tehran University

• This paper presents a novel idea in control system of exoskeletons for load carrying and power augmentation.
• The introduced control method is merely based on kinematic model and thus easy to implement practically.
• The result of simulation on a seven segmented dynamic model of Human-Exoskeleton shows that the interaction forces tend to zero and the position tracking error of exoskeleton is less than 2 degree



11:20-11:40 84 WeA2.2

Inverse Dynamics and Ground Reaction Force Estimation During Walking

Marzieh Mojaddarasil, Mohammad Jafar Sadigh
Isfahan University of Technology

• This paper looks into the forces applied to the joints, and the ground reaction forces (GRFs) during walking. In this vein, inverse dynamics of a human being are studied by considering a 3-dimensional, 7-link dynamic model which has 18 degrees of freedom.
• In this paper, for developing a completely theoretical model which has a good agreement with the reality, extra assumptions are developed, inspired by some experimental results. Within this framework of assumptions, the inverse dynamics problem is solved in the single and double support phases, by which the joint forces (especially the hip joint) during walking can be calculated.
• In this way, a method for calculating the joint forces and the GRFs, independent of the experimental tests, is developed..

11:40-12:00 200 WeA2.3

Push Recovery for NAO Humanoid Robot

Payam Ghassemi[1], Mehdi Tale Masouleh[1], Ahmad Kalhor[1]
[1]Human and Robot Interaction Lab.
[1]Faculty of New Sciences and Technologies
University of Tehran

• This paper presents some human-like strategies in the frontal plane for NAO humanoid robot.
• Three different strategies: ankle, hip, and ankle-hip strategies are considered.
• For recovery the robot from external push, as the main contribution, the virtual leg model is proposed.
• The control objective is defined as absorbing the external push and then recover the robot to its original configuration.
• PD controller is used to achieve the control objective.
• The performance and usage of these strategies and the model is validated by Webots.

12:00-12:20 67 WeA2.4

Energy Dissipation Rate Control for Planar Quadruped Bouncing Robot Based on the Property of Passive Dynamic Walking

Mechatronics I

Chairs: Aghil Yousefi-Koma, University of Tehran
Ahmad Afshar, Amirkabir University of Technology

11:00-11:20 103 WeA3.1

Management of Change propagation in Mechatronic Product Design Based on Minimum Cost of Changes

Seyed Amir Ahmadinejad
University of Applied Science and Technology
Ahmad Afshar
Amirkabir University of Technology

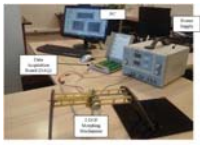
• A model-based method is proposed for managing the change propagation with the least cost
• The findings of this method help the engineers and designers to route the best change propagation path from the cost standpoint.
• Tenables the designers to identify the affected product components, and by implementing the necessary modifications, to achieve the optimum design of mechatronic products from the cost perspective

11:20-11:40 262 WeA3.2

Hysteresis Modeling and Experimental Validation of a Mechanism Actuated by Shape Memory Alloy Wires

Hassan Bayani, Aghil Yousefi Koma, S.S. Mohtasebi, M.R. Zakerzadeh
Center of Advanced Systems and Technologies (CAST), School of Mechanical Engineering, College of Engineering, University of Tehran, Tehran, Iran.

• In this paper, the generalized Prandtl-Ishlinskii model is trained by some experimental measured data obtained from an experimental test setup consisting of a mechanism actuated by a shape memory alloy wire.
• The parameters of the generalized Prandtl-Ishlinskii model are identified in order to adapt the model response to the real hysteretic nonlinearity.
• The accuracy of the obtained generalized Prandtl-Ishlinskii model in predicting nonlinear hysteric behavior of the system is validated using some different experimental data.

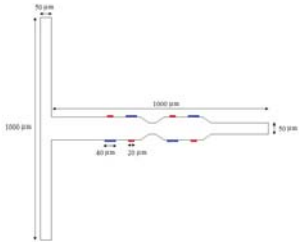


11:40-12:00 303 WeA3.3

Numerical Study of a Novel Microfluidic Electroosmotic Mixer with High and Fast Throughput

Nima Talebzadeh, Hadi Veladi
Microsystem Fabrication Lab, Faculty of Electrical Engineering, University of Tabriz, Tabriz, IRAN

• In this paper the design and numerical simulation of a novel microfluidic electroosmotic micromixer with high throughput and fast mixing time is presented.
• This micromixer is equipped with two sets of electrode arrays separated by a narrow channel within the mixing area.
• Due to constant outlet flow rate, some local narrow channel geometries through the mixing channel are created to achieve fast response and shorter mixing time.



12:00-12:20 94 WeA3.4

Study of a MEMS Hybrid Thermo-PZT Micro Switch

Human-inspired Robotics

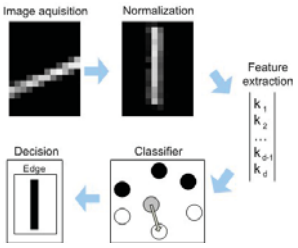
Chairs: Heinz Wörn, Karlsruhe Institute of Technology
Vahid Azimirad, University of Tabriz

11:00-11:20 16 WeA4.1

Analysis of Tactile Imprints for Multi-Fingered Robot Hands

Nicolas Gorges, Stefan Escaida Navarro, Heinz Wörn
Karlsruhe Institute of Technology

• We present a framework for classifying tactile imprints, including novel statistical features. The imprints are obtained on robots hands during the execution of a grasp.
• Sensors of different size are used: A big palm sensor, small sensors for a anthropomorphic pneumatic gripper and medium-sized sensors for an industrial gripper (SDH2)
• In our evaluation we discuss the classification performance as well as showing which are the characteristics of the observed shapes.



11:20-11:40 164 WeA4.2

Detecting finger movement through classification of electromyography signals for use in control of robots

Maryam Alimohammadi Soltanmoradi, Vahid Azimirad, Mahdiyeh Hajibabazadeh
School of Engineering Emerging Technologies, Department of Mechatronics Engineering
The University of Tabriz

• This paper presents a new method for surface electromyography (EMG) classification that it is used for controlling robot.
• Two EMG electrodes located on the human forearm are utilized to collect the EMG data. Time and frequency sets such as Number of Zero Crossings, Autoregressive and wavelet coefficients are considered as features. Then, Support Vector Machine is used as a classification method. Results show accuracy of proposed approach is nearly 80

11:40-12:00 299 WeA4.3

Regrasp Planning through Throwing and Catching

Seyed Javad Mousavi, Ellips Masehian, S.K. Moghaddam
Tarbiat Modares University

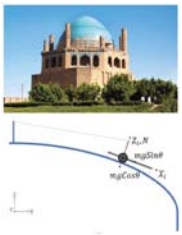
• Here we present a method in which estimating the position and orientation is based on objects features and how it is thrown.
• This method does not require calculating the dy-namic equations and all its corresponding processes can be performed offline.
• The planner uses an MLP neural network for learning from past throwing and catching experiences of objects with 9 differ-ent geometries. For the test set, five distinct objects with different geometries, densities, and center of mass were designed and tested.

12:00-12:20 186 WeA4.4

The Design, Implementation, and Stability Analysis of a Human-Inspired Dome-Tethered Robot

M.H Salehpour, B. Zamanian, Hadi Moradi
University of Tehran

• In this paper design and implementarion of a dome climbing robot is presented. This human inspired robot is a two-wheeled robot with a tether mechanism which is used to tether the robot to dome and help it for stable movement on dome surface.
• This human ispired climbing method has some advantages in comparision to other robotic systems, its natural stability even in case of power failure, operational high speed, light weight, low power consumption, and higher reliability.
• The robot is designed implemented in advanced robotic and intelligent systems lab at university of tehran and tested successfully on Hosseineh Ershad's dome.



Telerobotics

Chairs: Heidar Ali Talebi, Amirkabir University of Technology
Seyed Mehdi Rezaei, Amirkabir University of Technology

11:00-11:20 124 WeA5.1

Sliding Impedance Control for Improving Transparency in Telesurgery

Samim Khosravi, Arash Arjmandi, Hamid D. Taghirad
K. N. Toosi University of Technology

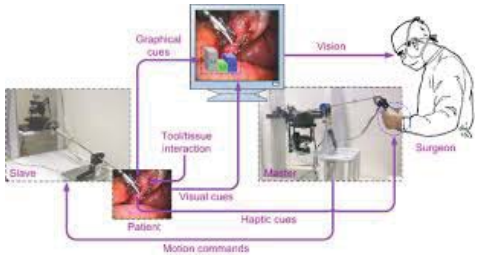
• Combining the fidelity measure with sliding impedance control for manipulating soft tissue in the teleopertion system
• Considering constant time delay on the fidelity measure formulation
• Simulating the teleopration system with haptic omni and SMOS(Stereotaxical Micro-telemanipulator for Ocular Surgery) robot as master and slave manipulators, respectively
• Applying impedance Control and sliding impedance control on the master and slave side, respectively. Parameters of the master controller are chosen to stabilize the whole teleoperation system, and slave controller's parameters are selected such that the fidelity measure was optimized.

11:20-11:40 207 WeA5.2

Nonlinear Control of a Non-Passive Bilateral Teleoperation in Presence of Unsymmetric Time Varying Delay

Fatemeh Koochaki, Iman Sharifi, Heidar Ali Talebi, Ali D. Mohammadi
Department of Electrical Engineering, Amirkabir University of Technology, Tehran 15914, Iran

• Nonlinear bilateral teleoperation systems are studied in this paper.
• Both terminals of teleoperation system are considered to be non-passive.
• The stability of the system in the presence of unsymmetrical time varying delays is investigated



11:40-12:00 58 WeA5.3

Improving Transparency in Macro-Micro Tele-manipulation by Means of External Force Estimation

Hamid Amini[1], Seyed Mehdi Rezaei[1], Vahid Dabbagh[1], Ahmed Sarhan[2], Noor Azizi[2]
[1]Amirkabir university of technology
[2]University of Malaya, Malaysia

• The use of teleoperation systems has been increased for micromanipulation tasks in the last decade. The most applications are where the operator is physically limited due to micro dimensions.
• This modification significantly improves the poor transparency in contact with the environment. To eliminate the external force measurement, a new modified force estimation algorithm is proposed for the master and slave robots.
• The main achievement is the stability of closed loop macro-micro teleoperation system in presence of the time varying human and environment forces. In addition, perfect tracking and force reflection have been proved in the steady state condition at the same time.

12:00-12:20 221 WeA5.4

Forbidden Region Virtual Fixture for Nonlinear Teleoperation Systems with Variable Time Delays

Mohammad Ali Soleimani, Iman Sharifi, H. Ali Talebi, Amir Abolfazl Suratgar, Fatemeh Koochaki
Amirkabir University of Technology

• Proposing a control scheme for development of stability and tracking performance of Forbidden Region Virtual Fixture for bilateral nonlinear teleoperation systems in presence of varying time delay.
• Proving stability and tracking performance of FRVF by proposed Lyapunov-Krasovskii's function.
• To demonstrate the proficiency of this approach, a pair of six DOF PHANToM Omni robots with nonlinear dynamics is used.

Control II

Chairs: Mehdi Keshmiri, Isfahan University of Technology
Mohammad Bagher Menhaj, Amirkabir University of Technology

14:20-14:40 208 WeB1.1

Coverage Control in Non-Convex Environment Considering Unknown Non-Convex Obstacles

Hamed F. Parapari[1], Farzaneh Abdollahi[1,2], Mohammad Bagher Menhaj[1]
[1]The Center of Excellence on Control and Robotics, Department of Electrical Engineering, Amirkabir University of Technology
[2]2Department of Electrical and Computer Engineering, Concordia University

• A novel cooperative algorithm is proposed to cover an unknown non-convex environment in the presence of unknown obstacles while avoiding fixed-collisions by a group of mobile robots.
• Convergence to the maximal coverage has been guaranteed.
• Comparing with the previous algorithms, this is able to deal with non-convex domains considering non-convex obstacles, covers more areas with limited sensing and save more energy.

14:40-15:00 243 WeB1.2

Robust Output Feedback Control for a Class of Nonlinear Systems

Mohamadreza Homayounzade, Mehdi Keshmiri
Isfahan University of Technology

• This paper investigates the problem of robust output feedback stabilization for a family of uncertain nonlinear systems. The proposed method contemplates uncertainties and results in asymptotic stability of system errors.
• The proposed method relaxes the debility of existing researches where the system nonlinearities are assumed to be bounded by a function of system output. In this note, the system nonlinearities under consideration are required to be bounded by a known function of state (not the system output), additionally no restrictive assumption is made on the system uncertainties

15:00-15:20 132 WeB1.3

Adaptive-neural network Attitude Controller for a Satellite in Presence of Unknown External Disturbances

Farhad Fani Saberi, Mansour Kabganian, Alireza Fazlyab, Abbas Ajorkar
Amirkabir University of Technology,Department of Mechanical Engineering

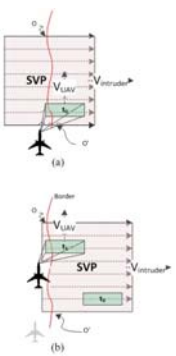
• This paper present an adaptive attitude controller for a satellite based on neural network.
• An attitude control based on nonlinear modified rodriguez parameters feedback control has been designed and uncertainties in the unknown disturbances torque have been considered. In order to eliminate the effect of these uncertainties, a multilayer neural network is designed afterward.
• The newly defined learning rules of the neural networks are established appropriately for a spacecraft and To prove the stability of the closed-loop dynamics with the control law, Lyapunov stability theory is considered.

15:20-15:40 165 WeB1.4

A new Spatiotemporal Virtual Plane to Evaluate the Performance of the Border Coverage Scenarios

Mohammad Ali Khesali, Seyed Mohammad Mehdi Dehghan, SeyedHadi Cheheltani
Space Research Institute

• A new graphical approach has been presented to evaluate the performance of a coverage scenario in a border patrolling mission.
• In these kinds of missions, great importance is given to continuous coverage of the entire surface over time, which maximizes the probability of detecting the intruders during crossing the border region.
• The graphical approach which is named "Spatiotemporal Virtual Plane" represents spatial coverage percentage and revisit time of different points of the border simultaneously.



Human-Robot Interface

Chairs: Ali Meghdari, Sharif University of Technology
Mohsen Bahrami, Amirkabir University of Technology

14:20-14:40 34 WeB2.1

Experimental Study on Task Space Control during Physical Human Robot Interaction

H. Sadeghian[1], L. Villani[2], Mehdi Keshmiri[3], B. Siciliano[2]
[1]University of Isfahan
[2]University of Naples Federico II
[3]Isfahan University of Technology

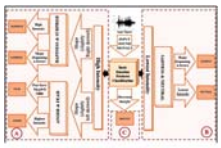
• New approaches for task space control during null space compliance control of a kinematically redundant robot are studied.
• The performances of the proposed controllers are verified through a variety of experiments on 7R KUKA lightweight robot arm.
• The algorithms do not require joint torque measurements.

14:40-15:00 68 WeB2.2

A system for feature classification of emotions based on Speech Analysis; Applications to Human-Robot Interaction

Mohammad Rabiei, Alessandro Gasparetto
Universitae di Udine Department of Electrical Engineering, Mechanical Engineering and Management, Via delle Scienze 206 - 33100 Udine (Italy)

• The efficiency of the introduced methodology was evaluated by experimental tests on the pitch (peak, value and range), the intensity of the speech, the formants and the speech rate using the freeware program (PRAAT)to classify basic emotions.
• The originality of our work lies in two main aspects that is using acoustic and phonetic properties of emotive speech with the minimal use of signal processing algorithms and less computation load.
• Figure 1 demonstrates an overview of the block diagram for extracting and classifying the multi-level human emotion.



15:00-15:20 172 WeB2.3

Learning of Gestures by Imitation using a Monocular Vision System on a Humanoid Robot

15:20-15:40 136 WeB2.4

Adaptive Handshaking between Humans and Robots, Using Imitation; Based on Gender-Detection and Person Recognition

Manipulators

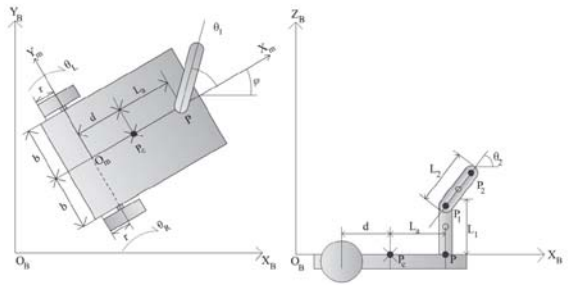
Chairs: Mohammad Mehdi Fateh , Shahrood University of Technology
Vladimir F. Filaretov, Leibniz Universität Hannover

14:20-14:40 282 WeB3.1

A Fuzzy Logic Based Motion Control for Nonholonomic Mobile Manipulator Robots

Mohammad Mahdi Fateh, Majid Abedinzadeh Shahri
Shahrood University

• A simple motion control strategy for wheeled mobile manipulator is presented in this paper.
• The robot modeling is considered.
• The proposed control has been designed to track the desired trajectory in the presence of uncertainties.
• An advantage of the proposed scheme is simplicity in designing.



14:40-15:00 101 WeB3.2

Synthesis of System for Automatic Formation of Multilink Manipulator Velocity

Vladimir F. Filaretov
Far Eastern Federal University, Institute for automation and control processes Far Eastern Branch of RAS
Dmitry A. Yukhimets
Far Eastern Federal University, Institute for automation and control processes Far Eastern Branch of RAS
Aleksandr Yu. Konoplin
Far Eastern Federal University

• This paper presents a method of synthesis of system for control of manipulator movement mode.
• Proposed method allows to set maximum possible variable speed of multilink manipulator effector movement along spatial trajectories with prevention of entrance of its electric actuators to saturation. Herewith, given dynamic accuracy of said movement is maintained
• The developed method is based on introduction of additional control loop of manipulator program signals.

15:00-15:20 37 WeB3.3

Recursive Kane formulation for deriving the equations of motion a chain of robotic arms

H.Reza Shafei, Mohsen Bahrami, Ali Kamali
Amirkabir University of Technology

• Proposing a new systematic method to drive the equation of motion of n-rigid robotic manipulators with revolute joints.
• Proposing a recursive method to reduce the computational complexity than nonrecursive algorithm which leads to less time for studying the dynamic behavior of the system.
• Using matrix of 3*3 in this proposed algorithm compared to the 4*4 has a lower computational complexity.

15:20-15:40 61 WeB3.4

Robust Integral Sign Error Controller with Online RBF Network Compensation for Robot Manipulators

Parallel Robots

Chairs: H. Zohoor, Sharif University of Science & Technology
H. Mohammadi Daniali, Noushirvani Institute of Technology

14:20-14:40 109 WeB4.1

Control of a Pneumatically Actuated 6-DOF Gough-Stewart Platform

J. Hajipour Machiani[1], Mehdi Tale Masouleh[1], Ahmad Kalhor[1], Mahmoud Ghafouri Tabrizi[2], F. Sanie[1]
[1]Human and Robot Interaction Laboratory, University of Tehran
[2]Qazvin Islamic Azad University

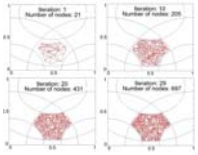
• This paper addresses the control of a pneumatically actuated Gough-Stewart platform with Six Degrees-of-Freedom that has six links and for the exact position of each link linear potentiometer are used.
• Air flow rate of each valve and rate of air pressure passing over each cylinder have been modelled based on displacement of each piston.
• By using PI controller, the displacement of each link have been controlled with changing the input voltage of the valves.

14:40-15:00 134 WeB4.2

Workspace Determination of Planar Parallel Robots via Progressive Growing Neural Gas Network

Roya Sabbagh Novin[1], Mojtaba Yazdani[2], Mehdi Tale Masouleh[1], Mohammad Bagher Menhaj[3]
[1]Human and Robot Interaction Laboratory, Faculty of New Sciences and Technologies, University of Tehran
[2]Department of Mechanical Engineering, AmirKabir University of Technology
[3]Department of Electrical Engineering, AmirKabir University of Technology

• This paper is a revival for the Growing Neural Gas Network approach in the context of kinematic analysis of parallel robots, more precisely workspace determination.
• The proposed algorithm is able to continue learning, adding units and connections, until a performance criterion has been met which leads to a clear workspace topology with minimal errors.
• As case studies, the workspace of two planar 3-DOF parallel robots with 3-RPR and 3-PRR structures are studied.



15:00-15:20 211 WeB4.3

Design, Developement, Dynamic Analysis and Control of a 2-DOF Spherical Parallel Mechanism

Esmaeil Rostami Jame Bozorgi[1], Iman Yahyapour[1], Amirhossein Karimi[1], Mehdi Tale Masouleh[1], Mojtaba Yazdani[2]
[1]Human and Robot Interaction Laboratory (TaarLab) Faculty of New Science and Technology University of Tehran
[2]Department of Mechanical Engineering, AmirKabir University of Technology, Tehran, Iran

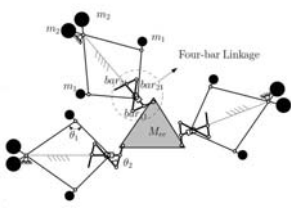
• This article deals with the design, dynamics, and control of a two degrees-of-freedom spherical parallel mechanism.
• The geometric and inertial parameters of the model are obtained via a CAD software .
• The dynamic analysis is based on a judicious concept in detaching the whole mechanism into several subsystems.
• A co-simulation between MATLAB and MD-Adams has been accomplished in order to control this mechanism.

15:20-15:40 219 WeB4.4

Stabilized Supervising Control of a Two-Wheel Mobile Manipulator

Mohammad Homayounpour, Mehdi Tale Masouleh
Human and Robot Interaction Laboratory (TaarLab) Faculty of New Science and Technology University of Tehran

• This article deals with dynamic balancing of two planar parallel 3-DOF mechanisms, namely 3-PRR and 3-RPRl.
• A new method for dynamic balancing of a prismatic pair is presented.
• Prismatic pair motion is simulated using a dynamic balanced rhombus configuration.
• The goal of this paper consists in cancellation of forces and moments transmitted from the end-effector to the base using the modeled dynamic balanced prismatic pair.



Aerial Robots

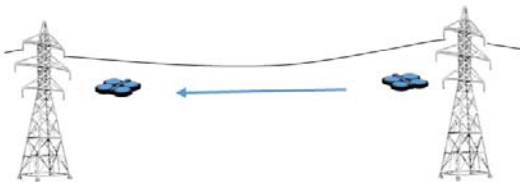
Chairs: Ali Khaki-Sedigh, K. N. Toosi University of Technology
Hassan Sayyaadi, University of Maryland

14:20-14:40 139 WeB5.1

A Vision-based Automatic Hotline Tracking Approach Using Unscented Kalman Filter

Sepehr Valipour, Hadi Moradi
Institute of Robotics and Intelligent System - University of Tehran

• Developing a novel method to detect power line in online video stream
• Implementing an unscented Kalman filter to generate smooth control signal in high disturbance environment
• Successfully simulated the system in a simulation environment and tested in a realistic experiment

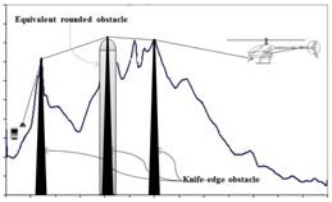


14:40-15:00 169 WeB5.2

Aerial Obstacle Estimation Using RSSI Observations based on OHLOSS Diffraction Model

Seyed Mohammad Mehdi Dehghan, Hadi Moradi
Advanced Robotics and Intelligent Systems laboratory, School of Electrical and Computer Engineering, University of Tehran

• This paper presents a new approach to estimate the location and height of the obstacle located between two UAVs using RSSI observations.
• The goal of developing this approach is to improve the localization of a radio frequency (RF) source by estimating the effect of obstacles on the signal attenuation.
• The main idea is in the distinction between the effects of obstacle(s) on the signal attenuation, i.e. the diffraction loss, and the path loss.
• The results of the simulations show that the proposed approach is able to map an obstacle between two RF sources.



15:00-15:20 29 WeB5.3

Adaptive Impedance Control of UAVs Interacting with Environment Using a Robot Manipulator

Hassan Sayyaadi, Mojtaba Sharifi
Sharif University of Technology

• A nonlinear adaptive impedance controller is proposed for UAVs equipped with a robot manipulator.
• The nonlinear dynamics model of the UAV plus the robot manipulator is considered in Cartesian coordinates.
• All of model parameters are considered to be completely uncertain and their estimation is updated using an adaptation law.
• The asymptotic tracking performance and global stability of the system are proved using Lyapunov stability theorem.

15:20-15:40 45 WeB5.4

Attitude Flight Control System Design of UAV using LQG-LTR Multivariable Control with Noise and Disturbance

Wheeled Mobile Robots

Chairs: Ali Ghaffari, K. N. Toosi University of Technology
Amir H. Shamekhi, K. N. Toosi University of Technology

16:00-16:20 40 WeC1.1

Networked Control of Mobile Robots Using Switched Systems Theory

Mozhgan Valedein Asl, Reza Mahboobi Esfanjani
Sahand University of Technology

• A switching static state feedback controller is designed for the posture stabilization of a wheeled mobile robot which is controlled over a communication network.
• The control problem is formulated as the asymptotic stabilization of a continuous time-delay switched system.
• Less conservative sufficient condition is derived to determine the switching controller gains by the solution of linear matrix inequalities.

16:20-16:40 42 WeC1.2

Derivation of Dynamic Equations and Parametric Analysis for Dual Arm Mobile Manipulators using Recursive Gibbs-Appell Formulation

Ebrahim Seidi, Ali Mohammad Shafei, Moharam Habibnejad Korayem
Iran University of Science and Technology

• Mobile manipulators with only single robotic arm have been successfully exploited in many tasks. The performance of these kinds of robotic system improves by assembling another robotic arm.
• this paper proposes a new solution to the problem of dynamic modeling of wheeled mobile manipulators with dual arms in an automatic and systematic approach. To avoid computing the "Lagrange multipliers" associated with the nonholonomic constraints, the equations of motion are derived according to the recursive Gibbs-Appell formulation.

16:40-17:00 227 WeC1.3

TL-OSR, a Low Cost Mobile Robot with Open-source Technology Based on Sensor Fusion

Arya Saboury[1], Mehdi Tale Masouleh[2]
[1]Department of Mechatronics, Qazvin Branch, Islamic Azad University, Qazvin, Iran.
[2]Human and Robot Interaction Laboratory, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran.

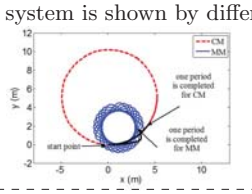
• This paper presents the state-of-the-art for building a low cost mobile robot, called TL-OSR, with open-source technology based on sensor fusion.
• KF and complementary filters with fusion data of a 9-axis open-source IMU are used.
• TL-OSR uses an open-source technology with real-time performance and low price equipments.
• TL-OSR can be used as a suitable open-source platform as a new class of mobile robots for educational and research purposes.

17:00-17:20 266 WeC1.4

Paths of Two-Wheeled Self-Balancing Vehicles in the Horizontal Plane

Azadeh Shariati, Ali Ghaffari, Amir H. Shamekhi
K. N. Toosi University of Technology

• This article is devoted to the dynamical analysis of the two-wheeled self-balancing vehicles in the horizontal plane. We obtained a modified dynamical formulation of the system previously. This new formulation is more detailed, in comparison with the commonly used formulations.
• The most important difference is the appearing of a new nonlinear coupling term in our dynamical equations. This term has significant effects on the dynamical behavior of the system.
• In this paper the effect of the new term on the free response of the system is shown and paths of the chassis in the horizontal plane are depicted under different initial conditions. The importance of this term and its effects on the paths of the system is shown by different simulations.



Spherical Robotics

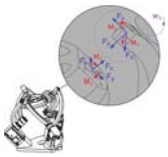
Chairs: H. Mohammadi Daniali, Noushirvani Institute of Technology
S Ali Akbar Moosavian, K. N. Toosi University of Technology

16:00-16:20 126 WeC2.1

Dynamic Modeling and Computed Torque Control of a 3-DOF Spherical Parallel Manipulator

Iman Yahyapour[1], Mojtaba Yazdani[2], Mehdi Tale Masouleh[1], Mahmoud Ghafouri Tabrizi[3]
[1]Human and Robot Interaction Laboratory, Faculty of New Sciences and Technologies, University of Tehran
[2]Department of Mechanical Engineering, AmirKabir University of Technology
[3]Mechatronic Eng. Depart., Qazvin Islamic Azad University

• This paper investigates the dynamic modeling of a 3-degree-of-freedom spherical parallel manipulator, called the Agile Eye
• The approach used in this paper is based on detaching the manipulator into several subsystems and applying a consecutive synergy between kinematic analysis, Lagrangian and Newtonian approaches.
• The results are put into contrast by the one obtained with a analyser software, MDAdams.

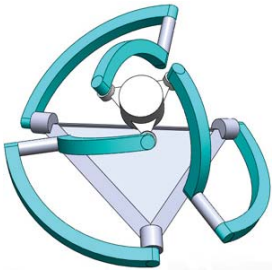


16:20-16:40 258 WeC2.2

Multi Criteria Design of a Spherical 3-DoF Parallel Manipulator for Optimal Dynamic Performance

Reza Khezrian, Ebrahim Abedloo, Mehran Farhadmanesh, Seyed Ali Akbar Moosavian
K. N. Toosi University of Technology

• The optimization of a spherical parallel manipulator was performed using genetic algorithm.
• Seven parameters which describe manipulator's geometry are considered.
• Although the main purpose was improving dynamic performance, workspace and kinematic behavior are involved to obtain better results.



16:40-17:00 305 WeC2.3

Ball Tracking with a 2-DOF Spherical Parallel Robot Based on Visual Servoing Controllers

Milad Eyvazi Hesar[1], Mehdi Tale Masouleh[2], Mohammad Bagher Menhaj[1], Ahmad Kalhor[2], Navid Kashi[2]
[2]Human and Robot Interaction Laboratory, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran
[1]Faculty of Electrical Engineering, Amirkabir University of Technology, Tehran, Iran

• In this paper, an image based control architecture is developed for a 2-degree-of-freedom (DOF) spherical parallel robot.
• A camera, with digital output, is installed on the end-effector to follow the moving ball for a given color which is set by the user in the developed GUI.
• A comparison between the image based PID controller and the sliding mode controller is conducted and performances are fully discussed.

17:00-17:20 284 WeC2.4

LQR Motion Control and Analysis of a Prototype Spherical Robot

Farshad Khademian Zadeh, Samira Asiri, Payman Moallem, Maryam Malek Zadeh
University of Isfahan

• In this article, we have made a prototype spherical rolling robot and proposed a linear quadratic regulator controller to stabilize the system. The dynamic model of this spherical rolling robot has been presented with 2-DOF pendulum located inside a spherical shell and considered as a plate-ball system. The motion of the system is generated with a servo motor for left and right direction and a DC motor for forward and backward motion.
• Simulation and experimental test have been carried out to show the effectiveness of the proposed controller.

Sensing

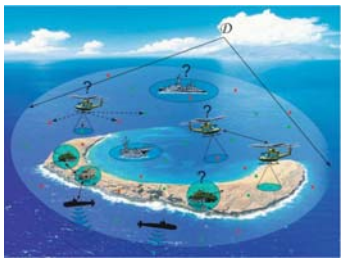
Chairs: Gholamreza Vossoughi, Sharif University of Technology
Mahyar Naraghi, Amirkabir University of Technology

16:00-16:20 59 WeC3.1

Coverage Control of a Dynamic Large-Scale Environment Using Sector-Based Sensors

Afshin Mohammadi, Farzaneh Abdollahi, Mahyar Naraghi
Amirkabir University of Technology

• A search and coverage control algorithm for a large scale domain of interest will be developed which guarantees to achieve the desired amount data from each point in the domain.
• The research tries to prepare the proposed algorithm to cover the interesting domain by faulty robots.
• The stability of the proposed algorithm is presented using Lyapunov stability theorem.

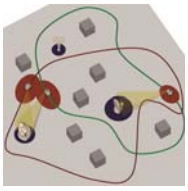


16:20-16:40 218 WeC3.2

Reduced Order Representation of Robust Multi-target Multi-agent Sensor Allocation

Hamidreza Nourzadeh[1], John E. McInroy[2], Nasrin Sadeghzadehyazdi[2], Siavash Fakhimi Derakhshan[3]
[1]Rensselaer Polytechnic Institute
[2]University of Wyoming
[3]K. N. Toosi University of Technology

• We propose a conversion algorithm that attains a minimal representation of Lorentz conic constraint in terms of quadratic conic form.
• We also suggest another method to achieve further dimensionality reduction in a particular conic constraints arising in robust multi-agent multi-target sensor allocation applications as well as many challenging combinatorial optimization problems with the similar nature.
• The efficacy of the proposed methods is confirmed in substantially reducing the number of variables and constraints with a minor effect on the solution quality.

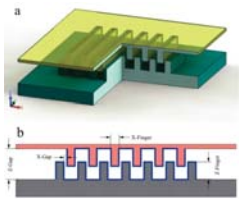


16:40-17:00 222 WeC3.3

Design, Analysis and Optimization of a Novel Capacitive Pressure Sensor Based on Vertical Comb-Grid Configuration

Vahid Ganjalizadeh, Nima Talebzadeh, Hadi Veladi
Microsystem Fabrication Lab, Faculty of Electrical Engineering, University of Tabriz, Tabriz, Iran

• This paper presents a novel structure for absolute capacitive pressure sensor which utilizes vertically arranged comb fingers to reach high sensitivity with wide dynamic range.
• A comb-grid structure is employed instead to improve the sensitivity.
• Design optimizations and analysis are derived by energy method which is in fine agreement with Finite Element Analysis (FEA) performed by ANSYS. Variation in sensing electrode area is also carried out to optimize the sensitivity.



17:00-17:20 118 WeC3.4

Empirical Study on Effect of Surface Texture and Grain Size on Displacement Measurement of Optical Flow Sensors

Trajectory Control

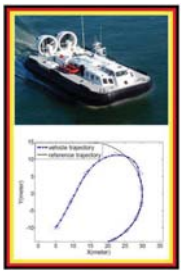
Chairs: Amin Nikoobin, Tarbiat Modares University
Payam Zarafshan, K. N. Toosi University of Technology

17:40-18:00 162 WeD1.1

Trajectory Tracking Control of Autonomous Underactuated Hovercraft Vehicles with Limited Torque

K. Shojaei
Najafabad Branch, Islamic Azad University

• Trajectory tracking control of autonomous underactuated hovercraft vehicles with limited torque has been addressed.
• Hyperbolic tangent function has been effectively utilized to design a saturated tracking controller.
• An adaptive robust technique has been employed to compensate parametric uncertainties, unmodeled dynamics and external disturbances induced by waves, wind and ocean currents.



18:00-18:20 149 WeD1.2

Optimal Nonlinear Trajectory Control of an Unmanned Helicopter

Alireza Abaspour, Seyed Hosein Sadati, Mohammad Sadeghi
Maleke-Ashtar University

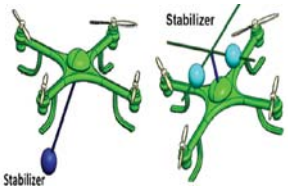
• Helicopter is inherently unstable and obtaining a comprehensive nonlinear dynamic model which covers the nonlinear properties of helicopter is a critical problem for researchers. In this paper in addition of introducing a nonlinear generic model of helicopter for nonlinear control purposes, a nonlinear control system based on dynamic inversion method is designed and illustrated.
• The simulation results showed that the proposed control design has a better performance in comparison with classical design of dynamic inversion controller.

18:20-18:40 193 WeD1.3

Trajectory Tracking of a Quadrotor using Stabilizing Mechanism

Rouhollah Pourbafarani, Seyed Ali Akbar Moosavian, Sara Sadr
K. N. Toosi University of Technology
Payam Zarafshan
College of Aburaihan, University of Tehran

• In this paper, the effect of using a stabilizing mechanism in trajectory tracking of a quad-rotor unmanned aerial vehicle has been investigated.
• Two different stabilizer mechanisms are designed;spherical pendulum stabilizer and cross stabilizer.
• Pid controller is designed for each stabilizer mechanism
• The performance of the system is investigated in the presence of disturbing forces.
• Obtained results show that instead of using complicated nonlinear control methods, the proposed stabilizer mechanism yields a desired performance.



18:40-19:00 174 WeD1.4

Indirect Optimal Trajectory Planning of Robotic Manipulators with Homotopy Continuation Technique

Mojtaba Moradi[1], Mahyar Naraghi[1], Amin Nikoobin[2]
[1]Amirkabir University of Technology
[2]Tarbiat Modares University

• Indirect solution for optimal trajectory planning of robotic manipulators is studied from practical point of view even for robots with high degree of freedom(HDOF). Derivation of optimality conditions for HDOF mechanical systems is symbolically cumbersome.
• Finding of inertia inverse matrix is time and memory consuming in symbolic computation. This paper extends traditional optimality condition extraction without inversing of inertia matrix by considering of application of holonomic and non-holonomic constraints. To overcome nonlinearity of the problem, simple homotopy continuation is proposed. Simulation indicates that the indirect solution with homotopy continuation is highly accurate and convergent and it can be intended for high-degree freedom robots..

Legged Robotics II

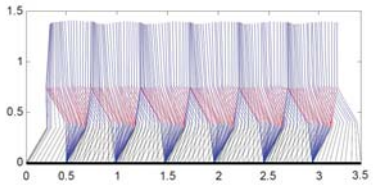
Chairs: Mohammad Mahjoob, University of Tehran
Ahmad Bagheri, University of Guilan

17:40-18:00 6 WeD2.1

Actor-Critic Reinforcement Learning for Walking Control of a Five-Link Bipedal Robot

Yasaman Vaghei, Ahmad Ghanbari, Sayyed Mohammad Reza Sayyed Noorani
Mechatronics Research Lab., School of Engineering Emerging Technologies, University of Tabriz, Tabriz, Iran

• In this paper, our main goal was to combine the advantages of artificial neural networks and the Reinforcement Learning (RL) to reduce the learning time length and enhance the control accuracy.
• We have implemented Actor-Critic RL with the artificial neural network units to control the actuation torques of a planar five-link bipedal robot and retain the passive torso in the vertical position.
• Results of our simulations reveal the perfect performance of our method in walking control of the biped.

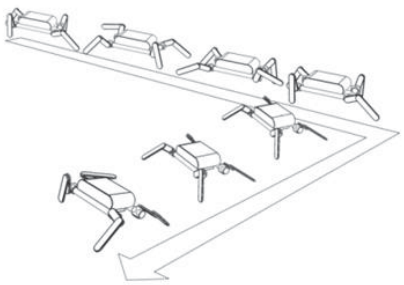


18:00-18:20 196 WeD2.2

New reptile based Omni-direction locomotion for a quadruped robot

Mahdi Bamdad, Arman Mardany
Shahrood University

• Proposing new way of omni direction gaiting
• Investigating and comparison between lizard and chameleon gaiting
• Investigating crab gaiting
• Chameleon-crab locomotion like gaiting

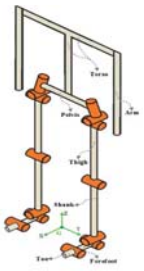


18:20-18:40 241 WeD2.3

Dynamics Modeling of a Biped Robot with Active Toe Joints

Mahdokht Ezati, Majid Khadiv, Seyed Ali Akbar Moosavian
K. N. Toosi University of Technology

• An approach to develop dynamics model and a novel method to solve inverse dynamics of a biped robot with active toe joints have been proposed.
• In our dynamics modeling method, the double support phase is divided into two subphases, depending on the action of toe joint.
• Consistent with constraints, unknown forces and moments are considered, using constraints relaxation method.
• The actual ZMP trajectory is computed using obtained reaction forces and moments to guarantee the feasibility of the walking pattern.



18:40-19:00 215 WeD2.4

Dynamics Synchronization of the Running of Planar Biped Robots with SLIP Model in Stance Phase

Mechatronics II

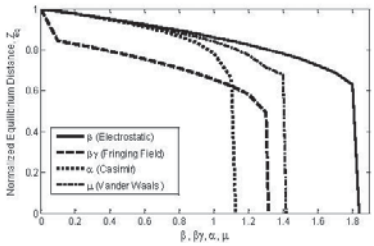
Chairs: Aria Alasty, Sharif University of Technology
Amirhossein Davaei Markazi, Iran University of Science & Technology

17:40-18:00 230 WeD3.1

Suppression of Dynamic Pull-in Instability in Electrostatically Actuated Strain Gradient Beams

Mohammad sajjad Edalatzadeh, Ramin Vatankhah, Aria Alasty
Sharif University of Technology and Shiraz University

• The threshold of the dynamic Pull-in instability was raised by using a boundary feedback controller.
• The beam was modeled by strain gradient elasticity theory aimed at a precise modeling of microstructures and Kantorovich method was employed to truncate the governing PDE.
• The beam is actuated by nonlinear distributed electrostatic force with first order fringing field correction.



18:00-18:20 255 WeD3.2

Gas Turbine Fault Detection and Identification by using Fuzzy clustering methods

Amin Ollah Khormali, Mahdi Aliyari Shooredeli
K. N. Toosi University of Technology

• This paper present a Fault Detection and Identification of a Gas Turbine using Fuzzy clustering methods .
• Feature selection methods have been applied on the data set.
• Results indicates that using feature selection methods improves the performance of the fuzzy clustering algorithms. Combination of the LDA feature selection and the GK fuzzy clustering algorithm performs a considerable performance. It is able to cluster the data set in to the exact clusters by more than 96 percent of correct rate.
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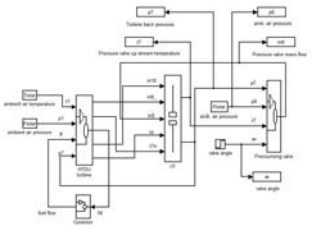


18:20-18:40 92 WeD3.3

High Precision Electro-Hydraulic Self Leveling Platform system

Behdad Geranmehr, K. Vafaee
Iran University of Science and Technology
A. Sadeghi
Malek-Ashtar University of Technology

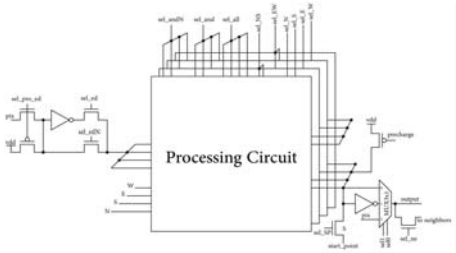
• This paper presents the design process and controlling method for a four-cylinder electro-hydraulic (EH) system.
• The control scheme used on this plant is a hybrid controller. It consists of a PID MIMO and a sliding mode controller. Moreover a fuzzy logic base algorithm is applied in order to sustain the synchronization.

18:40-19:00 206 WeD3.4

A High-Speed Low-Power Multitask Digital Cision Chip

Mohammad Sajad Noohi, Sayed Masoud Sayedi, Armin Jalili
Isfahan University of Technology

• A new pixel architecture for the use in a multitask digital vision chip is presented.
• The proposed circuit can output the result in each period of its operating frequency, which makes it very suitable for high speed real time applications.
• The array works at 80 MHz clock frequency, and each pixel of it only consumes3.4 W.
• The processing time is independent of the array size.



Control III

Chairs: Nader Narimanzadeh, University of Guilan
Mehdi Keshmiri, Isfahan University of Technology

9:30-9:50 78 ThA1.1

Adaptive H controller Based on GA-Hybrid Wavelet RBF for Robot Arm

Bahar Ahmadi, Hamid Nourisola
University of Tabriz

• This paper proposes an adaptive H control schemes based on a GA-hybrid wavelet RBF for tracking control of a two link robot arm. In this control scheme, GA-hybrid wavelet RBF is employed to construct the adaptive controller.
• A binary genetic algorithm (GA) is proposed to identify the wavelet RBF kernel function parameters. The most important characteristic of the proposed control scheme is its inherent robustness and its ability to handle the nonlinear behavior of the system. Finally, some simulation results are presented to show the utility of our proposed method.

9:50-10:10 154 ThA1.2

Modeling and Adaptive Sliding Mode Control of Samen SpaceCam

Arash Kiani, Seyed Kamal-eddin Mousavi Mashhadi
Iran University of Science and Technology

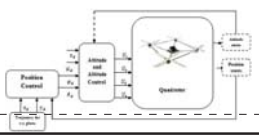
• This paper introduces a three degree-of-freedom cable-suspended robot driven by four cables which is called Samen SpaceCam. This system is widely being used in stadium complexes.
• We present an adaptive sliding mode control to overcome the uncertainties of system and to avoid estimating an upper bound of the system uncertainties. The proposed controller ensures stability of closed-loop system and the tracking error converges to zero exponentially.
• ASMC (adaptive sliding mode control) and SMC (sliding mode control) are compared together. The ASMC has better performance compared to SMC.

10:10-10:30 184 ThA1.3

Adaptive Robust Sliding Mode Controller Design for Full Control of Quadrotor with External Disturbances

Alireza Modirrousta, Mahdi Khodabandeh
Hamadan University of Technology

• A novel adaptive free chattering sliding mode has been proposed for robust attitude and altitude control of a quadrotor.
• A continuous sliding mode with adaptive disturbance observer and adaptive gain has been proposed for position control.
• In the control scheme instead of regular control input, the derivative of the control input has been achieved from non-singular terminal second-layer surface.
• Adaptive algorithm has been used to estimate the unknown bounds of disturbances and reduce the excitation high frequency unmodeled dynamics.
ItemThe proposed controller ensures finite time stability and asymptotic stability for inner and outer loop, respectively .



10:30-10:50 245 ThA1.4

Adaptive Position/Force Control of Robot Manipulators with Force Estimation

Mohamadreza Homayounzade, Mehdi Keshmiri
Isfahan University of Technology

• In this paper, we design an adaptive position/force controller for robot manipulators during constrained motion. The proposed controller can compensate for parametric uncertainties while only requiring the measurements of the positions and velocities of the robot arms, but not the measurements of forces at contact points.
• The effectiveness of the proposed method is investigated through the numerical simulation for a two-degrees-of-freedom robot manipulator acting on a horizontal worktable.

Social Robotics

Chairs: Minoo Alemi, Sharif University of Technology
Saeed Shiry Ghidary, Amirkabir University of Technology

9:30-9:50 65 ThA2.1

Effect of Utilizing a Humanoid Robot as a Therapy-Assistant in Reducing Anger, Anxiety, and Depression

Minoo Alemi, Ali Meghdari, Ashkan Ghanbarzadeh
Sharif University of Technology

• Treating cancer encompasses many invasive procedures that can be a source of distress in oncology patients. Distress itself can be a major obstruction in the path of acceptance of treatment and the patient's adaptation to it, thereby reducing its efficiency.
• The results of descriptive statistics and t-tests indicated that childrens stress, depression, and anger were alleviated during SRAT treatment and significant differences were observed between the two groups. Considering the positive reactions from children to the robot assistants presence at the intervention sessions one can anticipate that utilizing a humanoid robot with different communication abilities can be beneficial, both in elevation of efficacy in interventions, and fomenting kids to be more interactive and cooperative in their treatment sessions.

9:50-10:10 158 ThA2.2

An RGB-D Based Social Behavior Interpretation System for a Humanoid Social Robot

Abolfazl Zaraki[1], Manuel Giuliani[2], Maryam Banitalebi Dehkordi[3], Daniele Mazzei[1], Annamaria D'ursi[1], Danilo De Rossi[1]
[1]University of Pisa, Italy
[2]Dept. of Cyberphysical Systems Fortiss GmbH, Germany
[3]Scuola Superiore SantAnna, Italy

• We present a social behavior interpretation system that enables a humanoid social robot called FACE to recognize human social behavior by analyzing social communicative signals.
• The system receives the constructed RGB-D scene from a Kinect sensor, extracts information about body gesture and head pose from the scene using Microsoft Kinect SDK, and recognizes eight human social behaviors using a Hidden Markov Model (HMM).
• The evaluation of the system shows a weighted average recognition rate of 81% for all states.

10:10-10:30 259 ThA2.3

Social Robots as Assistants for Autism Therapy in Iran: Research in Progress

Alireza Taheri[1], Minoo Alemi[1], Ali Meghdari[1], Hamidreza Pouretemad[2], Nasim Mahboob Basiri[1]
[1]Sharif University of Technology
[2]Shahid Beheshti University

• Autistic children are often impaired in initiating and responding to Joint Attention. In recent years, there has been an increase in the application of robots in diagnosis and treatment of autism.
• In this paper, our focus is specifically on developing the necessary tools to improve joint attention and imitation in autistic children. To this end, the humanoid robots were programmed and teleoperated via Microsoft Kinect Sensor and PhantomOmni Haptic Robot to elicit reactions consisting of imitation of humans by the humanoid robots and vice versa. Our research target was to increase social interaction and involve autistic children in dyadic/triadic interactions..

10:30-10:50 274 ThA2.4

The Effect of Employing Humanoid Robots for Teaching English on Students Anxiety and Attitude

Minoo Alemi, Ali Meghdari, Ashkan Ghanbarzadeh
Sharif University of Technology

• This study aims at examining the effect of Robot Assisted language learning (RALL) on the anxiety level and attitude in the English language learning classroom. Forty-six female students who were beginners at the age of 12 participated in this study and were randomly assigned into two groups of RALL (30 students) and non-RALL (16 students).
• In this article, we have made a prototype spherical rolling robot and proposed a linear quadratic regulator controller to stabilize the system. The dynamic model of this spherical rolling robot has been presented with 2-DOF pendulum located inside a spherical shell and considered as a plate-ball system. The motion of the system is generated with a servo motor for left and right direction and a DC motor for forward and backward motion.

Medical Robotics/Rehabilitation Robots

Chairs: Farid Najafi, K. N. Toosi University of Technology
Seyed Hossein Sadati, K. N. Toosi University of Technology

11:10-11:30 295 ThB1.1

4-D body posture in sagittal plane for care-receiver patient can be estimated by using only two low-resolution tactile sensors mounted on robot arms

Mohammad Hadi Honarvar[1], Tatsuya Suzuki[2], Susumu Sato[3], Yasuhiro Nakamura[3]
[1]RIKEN Advanced Science Institute, Japan
[2]Nagoya University, Japan
[3]Tokai Rubber Industries Ltd., Japan

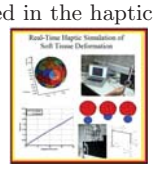
• In order to contribute in a more convenient transfer of the mobility impaired patients for both patients and caregivers, a two-armed nursing-care assistant robot for transferring patients between bed and wheelchair has been developed in our center.
• We have developed a flexible model-free method for real-time estimation of the care-receivers posture by this robot. This algorithm uses no sensor but a pair of soft low-resolution tactile sensors installed on the robots forearms.

11:30-11:50 18 ThB1.2

Real-Time Haptic Simulation of Soft Tissue Deformation

Ehsan Sadraei[1], Majid Mohammadi Moghaddam[1], Hosein Moazzen[2], Faeze Sayad Sijani[3]
[1]Department of Mechanical Engineering, Faculty of Engineering, Tarbiat Modares University
[2]Department of Computer Engineering, Faculty of Engineering, Gilan University
[3]Young Researchers and Elite Club, Qazvin Branch

• In early years developments in robotic, haptic and virtual reality devices have attended considerations on simulators as a tool of medical training.
• In this paper soft tissue deformation during contact of tool is modeled by finite element method. At the beginning equation of motion for whole object is extracted, in the next step the equation is discretized by FEM and Central Difference explicit numerical integrator logic in elemental, nodal and time domain.
• At the end the model codes are rewritten in robot compatible programming language for real-time simulation and then implemented in the haptic robotic interface.

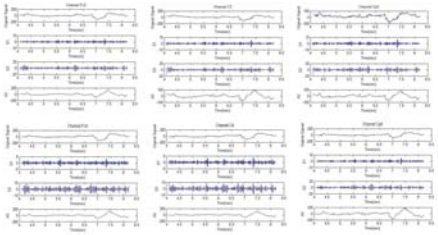


11:50-12:10 163 ThB1.3

Brain-Robot interface: distinguishing left and right hand EEG signals through SVM

Mahdiyeh Hajibabazadeh, Vahid Azimirad
School of Engineering Emerging Technologies, Department of Mechatronics Engineering,The University of Tabriz

• This paper presents a new method of implementing brain-robot interface.
• Wavelet transform decomposes the signal into frequency sub-bands as features. Then, support vector machine classifies features in two classes: left or right hand motor imagery.
• The output of classification is applied to move the arm of Tabriz-PUMA robot.



Medical Robotics/Rehabilitation Robots

Chairs: Farid Najafi, K. N. Toosi University of Technology
Seyed Hossein Sadati, K. N. Toosi University of Technology

12:10-12:30 115 ThB1.4

Gait Anaysis of Walking wth Scottish Rite Orthosis

Mahboubeh Keyvanara[1], Mohammad Jafar Sadigh[1], Mohammad Taghi Karimi[2]
[1]Isfahan University of Technology
[2]Isfahan University of Medical Sciences

• Legg-Calve-Perthes Disease is a disorder involving the closure of the blood supply of the femoral head, resulting in the hip bone turning black. The deformity of femoral head occurs as a result of hip joint irritability and this depends on the severity of the disease.
• The prerequisite of such model is the knowledge of gait performance of the patients using it and also the perception of the effects this orthosis has on the walking pattern of these patients. To this end, an analysis of the gait performance is given here. This analysis will then be useful in a path planning procedure. For the analysis to take place a Gait Analyzing System that uses QTM software to capture motions and also a Visual 3D software is used..

12:30-12:50 150 ThB1.5

Development of a Tactile Robot for Tumor Detection and Localization in Biological Liver Tissue

Motion Planning

Chairs: Hadi Moradi, University of Tehran
Ellips Masehian, Tarbiat Modares University

11:10-11:30 27 ThB2.1

Computing a configuration skeleton for motion planning of two round robots on a metric graph

Marjan Safi Samghabadi, Vitaliy Kurlin
Durham University, United Kingdom

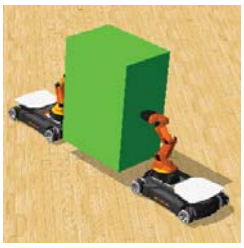
• A connected metric graph G with n vertices and without loops and multiple edges is given as an n by n matrix whose entry in i-th row and j-th column is the length of a single edge between vertices i,j. A robot in the metric graph G is the metric ball with a positive radius r and a center x in G. The configuration space OC(G,r) of 2 ordered robots in G is the set of all centers (x,y) such that x,y are at least 2r away from each other.
• We introduce the configuration skeleton CS(G,r) that captures all connectivity information of the larger space OC(G,r). We design an algorithm of time complexity O(n pow 2) to find all connected components of OC(G,r) that are maximal subsets of all safe positions (x,y) connectable by collision-free motions of the two round robot.

11:30-11:50 292 ThB2.2

Cooperative Object Transportation by Multiple Mobile Manipulators through a Hierarchical Planning Architecture

Taher Hekmatfar, Ellips Masehian, Seyed Javad Mousavi
Tarbiat Modares University

• In this paper a two-layered Centralized-Decentralized architecture is proposed for the problem of cooperative object transportation by multiple mobile manipulators.
• The purpose of two-layered approach is to integrate the advantages of both the centralized and decentralized planning. Distributed systems divide the processing load among the robots and improve the fault tolerance while Centralized systems can provide optimal solutions.

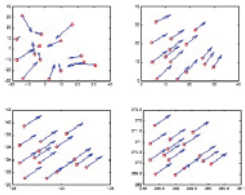


11:50-12:10 294 ThB2.3

Velocity Alignment for Multi Agents Based on Topological Distance with External Disturbances

Sanaz Dehghanipour, Mojtaba Barkhordari Yazdi, Malihe Maghfoori Farsangi
Shahid Bahonar University of Kerman

• Presentation velocity alignment problem for a group of mobile robots with second order dynamic in the presence of external disturbances.
• Communication between agents is based on relative topological distance.
• This problem is investigated for directed network in fixed and switching topology.
• Several conditions are offered to ensure all agents to reach velocity alignment while satisfying H-inf performance.
• Simulation results are illustrated that the flocking problem is possible with this algorithm.



Motion Planning

Chairs: Hadi Moradi, University of Tehran
Ellips Masehian, Tarbiat Modares University

12:10-12:30 60 ThB2.4

Modeling, Path Planning and Control of a Planar Five-Link Bipedal Robot by AFCTC

Alireza Mir Athari[1], Hamid D. Taghirad[2]
Faculty of Electrical Engineering, K.N.Toosi University of Technology

• This paper presents an online robust RGB-D SLAM algorithm which is implemented on a mobile robot.
• An improved switchable constraints robust pose graph SLAM is considered.
• Radial variance based hash functions are used for fast loop detection.
• An online comparison of image to map is used for improvement of loop detection algorithm results.

12:30-12:50 49 ThB2.5

An Improved Optimization Method for iSAM2

Rana Talaei Shahir, Hamid D. Taghirad
Advanced Robotics and Automated Systems (ARAS), Faculty of Electrical and Computer Engineering, K. N. Toosi University of Technology

• In Simultaneous Localization And Mapping (SLAM), it is expected to earn an accurate solution for large-scale environments with high speed of convergence.
• Although all the used optimization methods might be accepted in terms of accuracy and speed of convergence for small datasets, their solution for large-scale datasets are often far from the ground truth.
• In this paper, we have proposed and adjusted double Dogleg trust region method for iSAM2 - a state-of-the-art smoothing method for SLAM- to increase the performance and accuracy of the algorithm especially in large-scale datasets.

Cable Robots

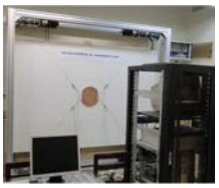
Chairs: Mohammad Eghtesad, Shiraz University
Mohammad A. Khosravi, Amirkabir University of Technology

11:10-11:30 137 ThB3.1

Implementation of Analytic Iterative Redundancy Resolution Technique on KNTU Cable Robot

Fereshteh Sabahi[1], Mohammad A Khosravi[1,2], Hamid D. Taghirad[2]
[1]Advanced Robotics and Automated Systems (ARAS)
[2]Industrial Control Center of Excellence (ICCE)
Faculty of Electrical Engineering, K.N. Toosi University of Technology, Tehran, Iran

• In this paper semi-analytic method AIRR for redundancy resolution in cable-driven robots is studied and implemented on KNTU planar cable robot. Furthermore, obtained results are compared to that of the previous methods in two steps; simulation and real-time implementation.
• The execution speed of the proposed method is fifteen times faster than the previous numerical method (CFSQP)
• The proposed algorithm can cope with possible time over run problem efficiently.

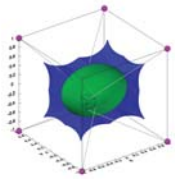


11:30-11:50 256 ThB3.2

On The Determination of the Maximal Inscribed Ellipsoid in the Wrench-Feasible Workspace of the Cable-Driven Parallel Robots

Hassan Bayani[1], Mehdi Tale Masouleh[1], Amirhossein Karimi[1], Philippe Cardou[2], Morteza Ebrahimi[1]
[1]Human and Robot Interaction Laboratory, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran
[2]Laboratoire de robotique, Departement de génie mécanique, Université Laval, Québec, QC, Canada

• This paper deals with determining the maximal regions within the Wrench-Feasible Workspace of cable-driven parallel robots using convex optimization.
• An approach is proposed in order to obtain the maximal-area ellipse and the maximal-volume ellipsoid within the wrench feasible workspace of the planar and spatial cable-driven parallel robots respectively, using convex optimization.

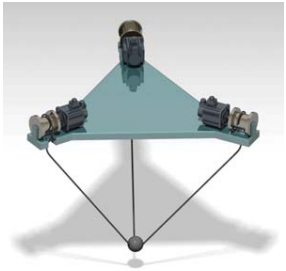


11:50-12:10 98 ThB3.3

Online Time-Optimal Trajectory Planning in Dynamic Workspace of Cable Suspended Robots

Ahmad Sharifi, Hamid D. Taghirad
K. N. Toosi University of Technology

• A general method for Online trajectory planning of cable suspended robots in dynamic workspace is proposed.
• Proposed method is simulated for a 3dof cable suspended robot.
• Alternative recipes are employed to decrease negative impacts of unwanted inputs and applying actuator constraints in trajectory planning.



Cable Robots

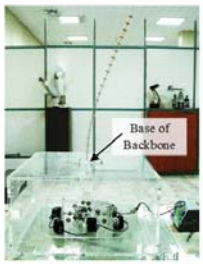
Chairs: Mohammad Eghtesad, Shiraz University
Mohammad A. Khosravi, Amirkabir University of Technology

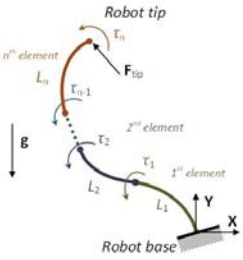
12:10-12:30 276 ThB3.4

Statics Modeling of Planar Continuum Robots Using Virtual Energy Method

Mohammad Dehghani, Seyed Ali Akbar Moosavian
K. N. Toosi University of Technology

• The statics of planar continuum robots is modeled using virtual energy method.
• The backbone kinematics is approximated by a series of constant-curvature elements.
• Using the proposed method, faster solutions are achieved.





12:30-12:50 301 ThB3.5

Using Singular Perturbation method for controlling an underactuated crane system with a flexible cable and large swing angle

Actuation

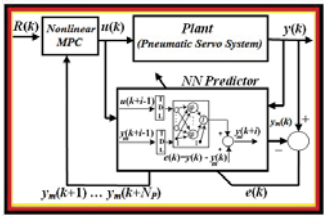
Chairs: Heidar Ali Talebi, Amirkabir University of Technology
Mohammad Farrokhi, Iran University of Science & Technology

11:10-11:30 145 ThB4.1

Offset-Free Adaptive Nonlinear Model Predictive Control for Pneumatic Servo System

Bahareh Vatankhah, Mohammad Farrokhi
Iran University of Science and Technology

• An adaptive nonlinear model predictive control method with zero steady-state error is proposed.
• A neural network model is trained online to predict the process output.
• The output of the neural network is modified by the current output prediction error.
• The stability of the closed-loop system is shown using the Lyapunov direct method.
• Simulation results on a pneumatic servo system show effectiveness of the control strategy as compared with the recently reported methods in literature under plant-model mismatches and unmeasured disturbances.



11:30-11:50 250 ThB4.2

System Identification of a Humanoid Robot Power Transmission System

A. Shahrokhshahi[1], Aghil Yousefi Koma[1], M. Khalili[2], M. Mahdavian[1]
[1]Center of Advanced Systems and Technologies(CAST),University of Tehran
[2]University of British Columbia

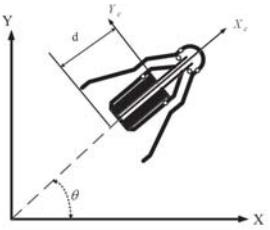
• This research focuses on modeling and identification of a prevailing type of robot power transmission system.
• Use of electrical actuators as well as utilizing gearbox and pulley-belt system is a common way to convey the power to the robotic joints.
• Identification of the powertrain system is an important issue in the robotic systems, and is an appropriate method to obtain the dynamic model of the powertrain system.
• Consequently, it leads to a more accurate dynamic model for the robotic systems, and dynamic behavior of the system can be more predictable.

11:50-12:10 36 ThB4.3

Dynamics Model and Adaptive Control of Underwater Fish-Like Micro Mobile Robot with PZT Actuator

Alireza Ahangarani Farahani, Amir Abolfazl Suratgar, Heidar Ali Talebi
Semnan University

• Presenting a new dynamic model, motion mechanism, and control for an underwater fish-like micro mobile robot.
• This micro mobile robot has two fins resulting in a 2 Degree of Freedom (DOF).
• Since this robot moves in any aqueous medium with various liquid densities, parameters of the micro mobile robot are uncertain; thus a controller based on adaptive control technique is designed.
• The main purpose of designing this adaptive controller is to make the robot track the desired trajectory.



Actuation

Chairs: Heidar Ali Talebi, Amirkabir University of Technology
Mohammad Farrokhi, Iran University of Science & Technology

12:10-12:30 97 ThB4.4

Parallel Spring Simplifies Actuator Output Torque And Improves Feed-Forward Learning

G. Soroush Maleki, K. Majid Nili Ahmad abadi
University of Tehran

• The paper presents a method to utilize parallel spring tu reduces higher frequency components of required torque in a manipulator
• The paper discriminates the differences between linear and non-linear spring
• The paper uses learning feed-forward learning scheme with adaptive spring to learn easier

12:30-12:50 238 ThB4.5

Error Based Self-Regulating PID Angle Control of Variable Structure Redundant Brushed DC Motors

Image and Vision

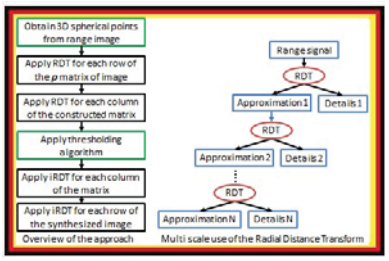
Chairs: Mansour Jamzad, Sharif University of Technology
Ahad Harati, Ferdowsi University Of Mashhad

11:10-11:30 133 ThB5.1

Range Image Denoising Using a Custom Built Multiscale Transform

Mahdi Aghaee Banadkuki, Ahad Harati
Ferdowsi University of Mashhad

• This paper present a custom transform based on lifting scheme to enhance range readings and enforce potentially present planar model.
• Multiscale representation for the underlying information captured by the sensor, decomposes input range data into approximation part which represents planarity consistent data and details which represents non-planar data
• Denoising of range image is done by a thresholding method

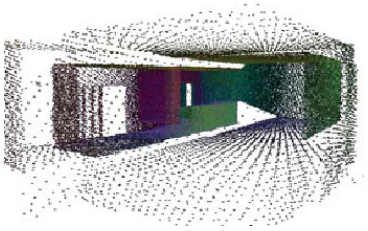


11:30-11:50 159 ThB5.2

Trilateral Filltering of Range Images Using Normal Inner Products

Taha Hamedani[1], Majid Yaghouti Jafarabad[2], Ahad Harati[3]
[1]Robot Perception Laboratory
[2]Computer Engineering Department
Ferdowsi University of Mashhad

• Based on the special characteristics of Kinect-like depth Data, we proposed a novel method based on Bilateral filter and estimation of Normal vectors to denoise range images captured by Kinect sensor.
• The proposed Trilateral filter uses difference of normal vector as similarity function and performs it beside Bilateral filter.



11:50-12:10 160 ThB5.3

Multi Scale CRF Based RGB-D Image Segmentation Using Inter Frames Potentials

Taha Hamedani[1], Ahad Harati[2]
[1]Robot Perception Laboratory
[2]Computer Engineering Department
Ferdowsi University of Mashhad

• In this paper, we enhance the quality of indoor scene segmentation by using region based pairwise potential obtained from edge of both surface normal and RGB image. We also define new cliques between labeling of two consecutive frames of sensor beside cliques between adjacent pixels in a single layer and cliques between two adjacent layers in multi-scale CRF model.
• Our experiments show that introducing new cliques between two consecutive frames, helps CRF to constrain to the previous labeling and attempts to modify this labeling based on current observation of Kinect sensor embedded on the mobile robot.

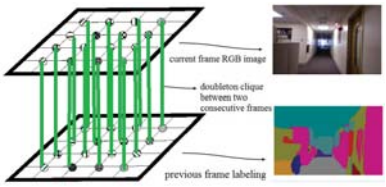


Image and Vision

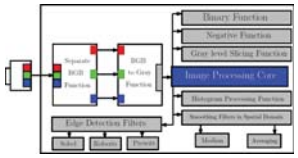
Chairs: Mansour Jamzad, Sharif University of Technology
Ahad Harati, Ferdowsi University Of Mashhad

12:10-12:30 171 ThB5.4

FPGA Design and Implementation for Real Time Vision Applications on NTACO Mobile Robot

J. Heshmatpanah[1], S. Boroumand[2], Mehdi Tale Masouleh[3]
[1]Department of Electronic,College of Electrical Engineering, Yadegare- Imam Khomeini (RAH) Branch,Islamic Azad University, Tehran, Iran.
[2]Department of Mechatronics,Qazvin Branch,Islamic Azad University,Qazvin, Iran.
[3]Human and Robot Interaction Lab,University of Tehran

• This paper represents the state-of-the-art of implementing a FPGA-based image processing algorithm in a mobile robot called NTACO. The objective consists in performing image processing algorithms in a real-time manner and to provide the possibility of overcoming obstacle avoidance problem based on local vision navigation.
• To this end, image processing techniques are used such as Sobel, Roberts and Prewitt edge finders, median and averaging filters, morphology and some related techniques.



12:30-12:50 155 ThB5.5

Transformation Invariant 3D Object Recognition Based On Information Complexity

Alireza Norouzzadeh Ravari, Hamid D. Taghirad
K. N. Toosi University of Technology

• In this paper, a similarity measurement from information theory is employed in order to recognize an object sample from a set of objects.
• From a NURBS model fitted to the observed point cloud, a complexity based representation is derived which is transformation invariant in the sense of Kolmogorov complexity.
• Experimental results on a set of 3D objects grabbed by a Kinect sensor indicates the applicability of the proposed method for object recognition tasks.