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Research Experience

Jul 2017 – present **Professor**
University of Alberta, Department of Electrical and Computer Engineering
Edmonton, Canada

Jul 2014 – Jun 2017 **Associate Professor**
University of Alberta, Department of Electrical and Computer Engineering
Edmonton, Canada

Sep 2008 – Jun 2014 **Assistant Professor**
University of Alberta, Department of Electrical and Computer Engineering
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Statistics

RG Score	36.97
Publications	259
Reads	35,269
Citations	2784

Skills & Activities

Skills Human-Robot Interaction, Robot Control, Sliding Mode Control, Haptics, Robotics, Mobile Robotics, Mechatronics, Control Theory, Advanced Control Theory, Kalman Filtering, Control and Instrumentation, Medical Robotics, HRI, System Identification, System Modeling, Systems Dynamics, Biorobotics, System Integration, Biomedical Devices, Medical Image Analysis, Brachytherapy, Minimally Invasive Surgery, Robotic Surgery, Medical Device Design, Control System Design, Teleoperation, Control Systems Engineering, Biomedical Engineering, Electrical Engineering, Controller Design, Controls, Actuators, Adaptive Control, Estimation, Virtual Environments, Automation & Robotics, Automation, Force Control, MATLAB Simulation, Control Systems

Publication Highlights

[authors]: *[title]*. [details]

Books

Angel Licona Rodriguez, Fei Liu, David Pinzon, Ali Torabi, Pierre Boulanger, Arnaud Lelevé, Richard Moreau, Minh Tu Pham, Mahdi Tavakoli: *Applications of Haptics in Medicine*. 01/2019;

Mahdi Tavakoli: *Haptics for Teleoperated Surgical Robotic Systems*. 01/2008; , DOI:10.1142/6816

Book Chapters

Jason Fong, Renz Ocampo, Mahdi Tavakoli: *Intelligent Robotics and Immersive Displays for Enhancing Haptic Interaction in Physical Rehabilitation Environments*. Haptic Interfaces for Accessibility, Health, and Enhanced Quality of Life, 01/2020: pages 265-297; , ISBN: 978-3-030-34229-6, DOI:10.1007/978-3-030-34230-2_10

Angel R. Licona, Fei Liu, David Pinzon, Ali Torabi, Pierre Boulanger, Arnaud Lelevé, Richard Moreau, Minh Tu Pham, Mahdi Tavakoli: *Applications of Haptics in Medicine*. Haptic Interfaces for Accessibility, Health, and Enhanced Quality of Life, 01/2020: pages 183-214; , ISBN: 978-3-030-34229-6, DOI:10.1007/978-3-030-34230-2_7

Bita Fallahi, Lingbo Cheng, Mahdi Tavakoli: *State observation and feedback control in robotic systems for therapy and surgery*. Control Systems Design of Bio-Robotics and Bio-Mechatronics with Advanced Applications, 12/2019: pages 504; Mara Conner., ISBN: 978-0-12-817463-0, DOI:10.1016/B978-0-12-817463-0.00002-2

Carlos Rossa, Mcniel Keri, Mahdi Tavakoli: *Brachytherapy Needle Steering Guidance Using Image Overlay*. Handbook of Research on Biomimetics and Biomedical Robotics, 01/2018: chapter 8: pages 191-215; IGI Global., ISBN: 9781522529934, DOI:10.4018/978-1-5225-2993-4.ch008

Mahdi Tavakoli: *Hand Haptic Perception*. The Human Hand as an Inspiration for Robot Hand Development, 01/2014: pages 189-200; Springer International Publishing., DOI:10.1007/978-3-319-03017-3_9

M. Bowthorpe, M. Tavakoli: *Advances towards beating heart surgery*. 01/2014: pages 135-158;

Mahdi Tavakoli, Rajni V Patel: *Haptics in Telerobotic Systems for Minimally Invasive Surgery*. Telesurgery, 01/2008: pages 113-124; Springer Berlin Heidelberg., DOI:10.1007/978-3-540-72999-0_9

Journal Publications

Bita Fallahi, Ronald Sloboda, Nawaid Usmani, Mahdi Tavakoli: *Image-Guided Observer-Based Control for Needle Steering*. IEEE Transactions on Control Systems Technology 10/2019; PP(99):1-8., DOI:10.1109/TCST.2019.2944117

Amir Zakerimanesh, Farzad Hashemzadeh, Ali Torabi, Mahdi Tavakoli: *A cooperative paradigm for task-space control of multilateral nonlinear teleoperation with bounded inputs and time-varying delays*. Mechatronics 08/2019; 62., DOI:10.1016/j.mechatronics.2019.102255

Lingbo Cheng, Mahdi Tavakoli: *A multilateral impedance-controlled system for haptics-enabled surgical training and cooperation in beating-heart surgery*. 07/2019;, DOI:10.1007/s41315-019-00099-y

Bita Fallahi, Michael Waine, Carlos Rossa, Ron Sloboda, Nawaid Usmani, Mahdi Tavakoli: *An Integrator-Backstepping Control Approach for 3D Needle Steering*. IEEE/ASME Transactions on Mechatronics 07/2019; PP(99)., DOI:10.1109/TMECH.2019.2930732

Amir Zakerimanesh, Farzad Hashemzadeh, Ali Torabi, Mahdi Tavakoli: *Controlled Synchronization of Nonlinear Teleoperation in Task-space with Time-varying Delays*. International Journal of Control Automation and Systems 05/2019;, DOI:10.1007/s12555-018-0120-z

Carlos Martinez, Mahdi Tavakoli: *Learning and Reproduction of Therapist's Semi-Periodic Motions during Robotic Rehabilitation*. Robotica 05/2019;, DOI:10.1017/S0263574719000651

Ali Torabi, Mohsen Khadem, Kourosh Zareinia, Garnette R. Sutherland, Mahdi Tavakoli: *Application of a Redundant Haptic Interface in Enhancing Soft-Tissue Stiffness Discrimination*. 01/2019; PP(99)., DOI:10.1109/LRA.2019.2893606

Renz Ocampo, Mahdi Tavakoli: *Improving User Performance in Haptics-Based Rehabilitation Exercises by Colocation of User's Visual and Motor Axes via a 3D Augmented-Reality Display*. 01/2019; PP(99):1-1., DOI:10.1109/LRA.2019.2891283

Jason Fong, Hossein Rouhani, Mahdi Tavakoli: *A Therapist-Taught Robotic System for Assistance During Gait Therapy Targeting Foot Drop*. 01/2019; PP(99):1-1., DOI:10.1109/LRA.2018.2890674

Mohsen Khadem, Carlos Rossa, Nawaid Usmani, Ron S. Sloboda, Mahdi Tavakoli: *Geometric control of 3D needle steering in soft-tissue*. Automatica 12/2018; 101., DOI:10.1016/j.automatica.2018.11.018

Lingbo Cheng, Mahdi Tavakoli: *Ultrasound image guidance and robot impedance control for beating-heart surgery*. Control Engineering Practice 09/2018; 81:9-17., DOI:10.1016/j.conengprac.2018.08.017

Mojtaba Sharifi, Hassan Salarieh, Saeed Behzadipour, Mahdi Tavakoli: *Patient-Robot-Therapist Collaboration Using Resistive Impedance Controlled Tele-Robotic Systems Subjected to Time Delays*. Journal of Mechanisms and Robotics 08/2018; 10(6)., DOI:10.1115/1.4040961

Amir Zakerimanesh, Farzad Hashemzadeh, Mahdi Tavakoli: *Task-Space Synchronization of Nonlinear Teleoperation with Time-Varying Delays and Actuator Saturation*. International Journal of Control 08/2018;, DOI:10.1080/00207179.2018.1506158

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Thomas Lehmann, Ronald Sloboda, Nawaid Usmani, Mahdi Tavakoli: *Model-Based Needle Steering in Soft Tissue via Lateral Needle Actuation*. 07/2018; PP(99):1-1., DOI:10.1109/LRA.2018.2858001

Seiichiro Katsura, Jordi Artigas, Mahdi Tavakoli, Shahin Sirouspour, Keehoon Kim, Dongjun Lee: *Section focused on new horizons in telerobotics for real-life applications*. Advanced Robotics 07/2018; 32(13):681-682., DOI:10.1080/01691864.2018.1503631

Ting Yang, Junfeng Hu, Wei Geng, Dan Wang, Yili Fu, Mahdi Tavakoli: *Hybrid Analog/Digital Control of Bilateral Teleoperation Systems*. Journal of Dynamic Systems Measurement and Control 07/2018; 140(12):121001., DOI:10.1115/1.4040440

Xia Liu, Mahdi Tavakoli: *Bilateral Adaptive Control of Nonlinear Teleoperation Systems With Uncertain Dynamics and Dead-Zone*. Journal of Dynamic Systems Measurement and Control 06/2018; 140(12)., DOI:10.1115/1.4040666

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Mojtaba Sharifi, Saeed Behzadipour, Mahdi Tavakoli: *Cooperative modalities in robotic tele-rehabilitation using nonlinear bilateral impedance control*. Control Engineering Practice 10/2017; 67:52-63., DOI:10.1016/j.conengprac.2017.07.002

S. Sepehr Tabatabaei, Heidar Ali Talebi, Mahdi Tavakoli: *An adaptive order/state estimator for linear systems with non-integer time-varying order*. Automatica 10/2017; 84:1-9., DOI:10.1016/j.automatica.2017.06.042

Weihua Li, Liang Ding, Haibo Gao, Mahdi Tavakoli: *Haptic Tele-Driving of Wheeled Mobile Robots Under Nonideal Wheel Rolling, Kinematic Control and Communication Time Delay*. IEEE Transactions on Systems, Man, and Cybernetics: Systems 08/2017; PP(99):1-12., DOI:10.1109/TSMC.2017.2738670

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Mohammad Najafi, Kim Adams, Mahdi Tavakoli: *Robotic learning from demonstration of therapist's time-varying assistance to a patient in trajectory-following tasks*. IEEE International Conference on Rehabilitation Robotics : [proceedings] 07/2017; 2017:888-894., DOI:10.1109/ICORR.2017.8009361

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Nooshin Jafari, Kim Adams, Mahdi Tavakoli, Sandra Wiebe, Heidi Janz: *Usability Testing of a Developed Assistive Robotic System with Virtual Assistance for Individuals with Cerebral Palsy: A Case Study*. Disability and Rehabilitation Assistive Technology 06/2017; 13(6)., DOI:10.1080/17483107.2017.1344884

Bita Fallahi, Carlos Rossa, Ron S. Sloboda, Nawaid Usmani, Mahdi Tavakoli: *Sliding-based image-guided 3D needle steering in soft tissue*. Control Engineering Practice 06/2017; 63:34-43., DOI:10.1016/j.conengprac.2017.04.001

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S. Sepehr Tabatabaei, H.A. Talebi, M. Tavakoli: *A novel adaptive order/parameter identification method for variable order systems application in viscoelastic soft tissue modeling*. Chaos Solitons & Fractals 05/2017;, DOI:10.1016/j.chaos.2017.04.005

Seyed Farokh Atashzar, Mahya Shahbazi, Mahdi Tavakoli, Rajni V Patel: *A grasp-based passivity signature for haptics-enabled human-robot interaction: Application to design of a new safety mechanism for robotic rehabilitation*. The International Journal of Robotics Research 04/2017;, DOI:10.1177/0278364916689139

Carlos Rossa, Mahdi Tavakoli: *Issues in Closed-Loop Needle Steering*. Control Engineering Practice 03/2017; 62:55-69., DOI:10.1016/j.conengprac.2017.03.004

M.F. Jamaluddin, S. Ghosh, M.P. Waine, M. Tavakoli, J. Amanie, A.D. Murtha, D. Yee, N. Usmani: *Intraoperative factors associated with stranded source placement accuracy in low–dose rate prostate brachytherapy*. Brachytherapy 02/2017; 16(3)., DOI:10.1016/j.brachy.2017.01.007

Muhammad F. Jamaluddin, Sunita Ghosh, Michael P. Waine, Ronald S. Sloboda, Mahdi Tavakoli, John Amanie, Albert D. Murtha, Don Yee, Nawaid Usmani: *Quantifying 125I placement accuracy in prostate brachytherapy using postimplant transrectal ultrasound images*. Brachytherapy 02/2017;, DOI:10.1016/j.brachy.2016.11.015

Mohammad Najafi, Mojtaba Sharifi, Kim Adams, Mahdi Tavakoli: *Robotic assistance for children with cerebral palsy based on learning from tele-cooperative demonstration*. 01/2017;, DOI:10.1007/s41315-016-0006-2

L. Ding, Weihua Li, Zhen Liu, Weidong Wang, Haibo Gao, Mahdi Tavakoli: *Kinematic Bilateral Tele-Driving of Wheeled Mobile Robots Coupled with Slippage*. IEEE Transactions on Industrial Electronics 01/2017;

Ala Shariati, Mahdi Tavakoli: *A Descriptor Approach to Robust Leader-Following Output Consensus of Uncertain Multi-Agent Systems with Delay*. IEEE Transactions on Automatic Control 12/2016; PP(99):1-1., DOI:10.1109/TAC.2016.2643444

Carlos Rossa, Thomas Lehmann, Ron Sloboda, Nawaid Usmani, Mahdi Tavakoli: *A Data-Driven Soft Sensor for Needle Deflection in Heterogeneous Tissue using Just-in-Time Modelling*. Medical & Biological Engineering & Computing 11/2016; 55(8)., DOI:10.1007/s11517-016-1599-1

Farzad Hashemzadeh, Mojtaba Sharifi, Mahdi Tavakoli: *Nonlinear trilateral teleoperation stability analysis subjected to time-varying delays*. Control Engineering Practice 11/2016; 56:123-135., DOI:10.1016/j.conengprac.2016.08.004

Nooshin Jafari, Kim D Adams, Mahdi Tavakoli: *Haptics to improve task performance in people with disabilities: A review of previous studies and a guide to future research with children with disabilities*. 10/2016; 3., DOI:10.1177/2055668316668147

Mohsen Khadem, Carlos Rossa, Nawaid Usmani, Ron S. Sloboda, Mahdi Tavakoli: *A Two-Body Rigid/Flexible Model of Needle Steering Dynamics in Soft Tissue*. IEEE/ASME Transactions on Mechatronics 10/2016; 21(5):1-1., DOI:10.1109/TMECH.2016.2549505

Mohsen Khadem, Carlos Rossa, Nawaid Usmani, Ron S. Sloboda, Mahdi Tavakoli: *Semi-Automated Needle Steering in Biological Tissue Using an Ultrasound-Based Deflection Predictor*. Annals of Biomedical Engineering 09/2016; 45(4)., DOI:10.1007/s10439-016-1736-x

Muhammad Faisal Jamaluddin, Sunita Ghosh, Michael Waine, Ronald Sloboda, Mahdi Tavakoli, John Amanie, Don Yee, Albert Murtha, Nawaid Usmani: *110: Intraoperative Factors Associated with Iodine-125 Placement Accuracy in Prostate Brachytherapy*. Radiotherapy and Oncology 09/2016; 120:S42., DOI:10.1016/S0167-8140(16)33509-5

Seyed Farokh Atashzar, Mahya Shahbazi, Mahdi Tavakoli, Rajni V. Patel: *A Passivity-Based Approach for Stable Patient-Robot Interaction in Haptics-Enabled Rehabilitation Systems: Modulated Time-Domain Passivity Control*. IEEE Transactions on Control Systems Technology 08/2016; 25(3)., DOI:10.1109/TCST.2016.2594584

Thomas Lehmann, Carlos Rossa, Nawaid Usmani, Ron Sloboda, Mahdi Tavakoli: *A Real-Time Estimator for Needle Deflection During Insertion Into Soft Tissue Based on Adaptive Modeling of Needle-Tissue Interactions*. IEEE/ASME Transactions on Mechatronics 08/2016; –(–)., DOI:10.1109/TMECH.2016.2598701

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S. Farokh Atashzar, Mahya Shahbazi, Olivia Samotus, Mahdi Tavakoli, Mandar Jog, Rajni Patel: *Characterization of Upper-Limb Pathological Tremors: Application to Design of an Augmented Haptic Rehabilitation System*. IEEE Journal of Selected Topics in Signal Processing 08/2016; 10(5):1-1., DOI:10.1109/JSTSP.2016.2530632

Meaghan Bowthorpe, Mahdi Tavakoli: *Generalized Predictive Control of a Surgical Robot for Beating-Heart Surgery under Delayed and Slowly-Sampled Ultrasound Image Data*. 07/2016; 1(2):1-1., DOI:10.1109/LRA.2016.2530859

Carlos Rossa, Jason Fong, Nawaid Usmani, Ronald Sloboda, Mahdi Tavakoli: *Multi-Actuator Haptic Feedback on the Wrist for Needle Steering Guidance in Brachytherapy*. 07/2016; 1(2):1-1., DOI:10.1109/LRA.2016.2528295

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Mohsen Khadem, Carlos Rossa, R. S. Sloboda, Nawaid Usmani, Mahdi Tavakoli: *Mechanics of Tissue Cutting During Needle Insertion in Biological Tissue*. 07/2016; PP(2-99):1-1., DOI:10.1109/LRA.2016.2528301

Mahdi Maaref, Alireza Rezazadeh, Kimia Shamaei, Renz Ocampo, Mahdi Tavakoli: *A Bicycle Cranking Model for Assist-as-Needed Robotic Rehabilitation Therapy Using Learning from Demonstration*. 07/2016; 1(2):1-1., DOI:10.1109/LRA.2016.2525827

Mahya Shahbazi, Seyed Farokh Atashzar, Mahdi Tavakoli, Rajni V. Patel: *Robotics-Assisted Mirror Rehabilitation Therapy: A Therapist-in-the-Loop Assist-as-Needed Architecture*. IEEE/ASME Transactions on Mechatronics 05/2016; 21(4):1-1., DOI:10.1109/TMECH.2016.2551725

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Weihua Li, Zhen Liu, Haibo Gao, Xuefeng Zhang, Mahdi Tavakoli: *Stable kinematic teleoperation of wheeled mobile robots with slippage using time-domain passivity control*. Mechatronics 05/2016; 39., DOI:10.1016/j.mechatronics.2016.05.005

Muhammad F. Jamaluddin, Sunita Ghosh, Michael Waine, Ronald S. Sloboda, Mahdi Tavakoli, John Amanie, Albert D. Murtha, Don Yee, Nawaid Usmani: *Quantifying Iodine-125 Placement Accuracy in Prostate Brachytherapy Using Post-Implant Transrectal Ultrasound Images*. Brachytherapy 05/2016; 15(1):S180., DOI:10.1016/j.brachy.2016.04.330

Michael Waine, Carlos Rossa, Ron Sloboda, Nawaid Usmani, Mahdi Tavakoli: *Needle Tracking and Deflection Prediction for Robot-Assisted Needle Insertion Using 2D Ultrasound Images*. 03/2016; 01(01):1640001., DOI:10.1142/S2424905X16400018

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Carlos Rossa, Mohsen Khadem, Ronald Sloboda, Nawaid Usmani, Mahdi Tavakoli: *Adaptive Quasi-Static Modelling of Needle Deflection During Steering in Soft Tissue*. 01/2016; 1(2):1-1., DOI:10.1109/LRA.2016.2527065

Isao Sakamaki, Kim Adams, Maria Gomez, Javier Leonardo Castellanos Cruz, Mahdi Tavakoli, Nooshin Jafari, Heidi Janz: *Preliminary testing by adults of a haptics-assisted robot platform designed for children with physical impairments to access play*. Journal of Assistive Technologies 01/2016; 30(5)., DOI:10.1080/10400435.2017.1318974

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