

# **2023 International Symposium on Medical Robotics (ISMР 2023)**

**Atlanta, Georgia, USA**  
**19 – 21 April 2023**



**IEEE Catalog Number:** CFP23N45-POD  
**ISBN:** 979-8-3503-0163-2

**Copyright © 2023 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP23N45-POD
ISBN (Print-On-Demand):	979-8-3503-0163-2
ISBN (Online):	979-8-3503-0162-5
ISSN:	2831-3690

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## TABLE OF CONTENTS

Development of a Preliminary Use Case for Socially Assistive Robot-Augmented Early Intervention with Clinical Stakeholders .....	1
<i>Madeline M. Blankenship, Cathy Bodine</i>	
Smart Room with AI Capabilities for Efficient and Safe Doctor Checkup in the COVID Era .....	9
<i>Luis A. Mateos</i>	
Preliminary Theoretical Considerations of a Hand Orthosis Based on a Prestressed, Compliant Structure .....	15
<i>Leon Schaeffer, David Herrmann, Valter Boehm</i>	
In Situ Flexible Needle Adjustment Towards MRI-Guided Spinal Injections Based on Finite Element Simulation .....	22
<i>Yanzhou Wang, Yangsheng Xu, Ka-Wai Kwok, Iulian Iordachita</i>	
Open Source MR-Safe Pneumatic Radial Inflow Motor and Encoder (PRIME): Design and Manufacturing Guidelines* .....	29
<i>Anthony L. Gunderman, Milad Azizkhani, Saikat Sengupta, Kevin Cleary, Yue Chen</i>	
Closed-Form Kinematic Model and Workspace Characterization for Magnetic Ball Chain Robots.....	36
<i>Giovanni Pittiglio, Margherita Mencattelli, Pierre E. Dupont</i>	
N-mirror Robot System for Laser Surgery: A Simulation Study .....	43
<i>Guangshen Ma, Weston Ross, Patrick J. Codd</i>	
A Radial Folding Mechanism to Enable Surgical Continuum Manipulators to Fit Through Smaller Ports.....	50
<i>Mariana E. Smith, Daniel S. Esser, Margaret Rox, Alan Kuntz, Robert J. Webster</i>	
What Happens When Pneu-Net Soft Robotic Actuators Get Fatigued? .....	56
<i>Jacqueline Libby, Aniket A. Somwanshi, Federico Stancati, Gayatri Tyagi, Aadit Patel, Naigam Bhatt, Johnross Rizzo, S. Farokh Atashzar</i>	
Physiological Motion Compensation in Patch Clamping Using Electrical Bio-Impedance Sensing .....	62
<i>Kaat Van Assche, Yao Zhang, Mouloud Ourak, Eric Verschooten, Philip X. Joris, Emmanuel Vander Poorten</i>	
Development of Robot-Assisted Ultrasound System for Fetoscopic Tracking in Twin to Twin Transfusion Syndrome Surgery .....	69
<i>Yuyu Cai, Ayoob Davoodi, Ruixuan Li, Mouloud Ourak, Kenan Niu, Jan Deprest, Emmanuel Vander Poorten</i>	
Towards Safe and Efficient Reinforcement Learning for Surgical Robots Using Real-Time Human Supervision and Demonstration.....	76
<i>Yafei Ou, Mahdi Tavakoli</i>	
Concentric Tube Robot Optimization and Path Planning for Epilepsy Surgeries.....	83
<i>Zhilong Zou, Jessica Burgner-Kahrs, Thomas Looi, James Drake</i>	
Robotic Optical Coherence Tomography of Human Subjects with Posture-Invariant Head and Eye Alignment in Six Degrees of Freedom .....	90
<i>Mark Draelos, Pablo Ortiz, Amit Narawane, Ryan P. McNabb, Anthony N. Kuo, Joseph A. Izatt</i>	

Statics Modeling of Discrete Joint Surgical Probes with Tendon-Based Stiffening .....	97
<i>Yilin Cai, Andrew L. Orekhev, Howie Choset</i>	
Markerless Suture Needle Tracking from a Robotic Endoscope Based on Deep Learning.....	104
<i>Yiwei Jiang, Haoying Zhou, Gregory S. Fischer</i>	
Using a Force-Controlled Robot for Probing-Based Registration and Automated Bone Drilling in Pedicle Screw Placement Procedures .....	111
<i>Saman Vafadar, Elie Saghbiny, Antoine Harlé, Guillaume Morel</i>	
Koopman Operator-Based Extended Kalman Filter for Cosserat Rod Wrench Estimation.....	118
<i>Lingyun Zeng, S. M. Hadi Sadati, Christos Bergeles</i>	
An Intelligent Control Approach for Reduction of Gait Asymmetry in Transfemoral Amputees .....	125
<i>Zunaed Kibria, Bhanu Prasad Kotamraju, Sesh Commuri</i>	
cHand: Open Source Hand Posture Visualization in CHAI3D.....	133
<i>Edoardo Battaglia, Ann Majewicz Fey</i>	
The Modernization of Preoperative Scoliosis Curvature Correction Methods for Pediatric Patients.....	139
<i>Charles Brenner, Kinsey Herrin, Alexander Ambrose, Brian Emling, Michael Schmitz, Richard Welling, Frank L. Hammond</i>	
Independent Control of Two Magnetic Robots Using External Permanent Magnets: A Feasibility Study.....	146
<i>Joshua Davy, Tomas Da Veiga, Giovanni Pittiglio, James H. Chandler, Pietro Valdastri</i>	
An Evaluation Platform for Catheter Ablation Navigation.....	153
<i>Florian Heemeyer, Christophe Chautems, Quentin Boehler, José L. Merino, Bradley J. Nelson</i>	
Vision-Based Shared Control for Telemanipulated Nasopharyngeal Swab Sampling.....	160
<i>Stephan Andreas Schwarz, Ulrike Thomas</i>	
Towards the Development of a MEMS-Based Force Sensor for <i>in vivo</i> Tumor Tissue Demarcation.....	167
<i>Nidhi Malhotra, Kimberly Hoang, Jaydev P. Desai</i>	
Towards Biomechanics-Aware Design of a Steerable Drilling Robot for Spinal Fixation Procedures with Flexible Pedicle Screws.....	173
<i>Susheela Sharma, Yuelan Sun, Sarah Go, Jordan P. Amadio, Mohsen Khadem, Amir Hossein Eskandari, Farshid Alameighi</i>	
Deep Kernel and Image Quality Estimators for Optimizing Robotic Ultrasound Controller Using Bayesian Optimization .....	179
<i>Deepak Raina, S. Chandrashekara, Richard Voyles, Juan Wachs, Subir Kumar Saha</i>	
Modeling Tendon-Actuated Concentric Tube Robots .....	186
<i>Yash Chitalia, Abdulhamit Donder, Pierre E. Dupont</i>	
Smoothness Constrained Curiosity Driven Multicamera Trajectory Optimization for Robot- Assisted Minimally Invasive Surgery.....	193
<i>Divas Subedi, Wenfan Jiang, Ramisa Tahsin Rahman, Heidi Zhang, Kevin Huang, Yun-Hsuan Su</i>	
A Structurally Enhanced Neck Exoskeleton to Assist with Head-Neck Motion .....	200
<i>David Demaree, Haohan Zhang</i>	

Towards Closed-Loop Control of the Modified COAST Guidewire Under Fluoroscopic Imaging for Endotracheal and Endovascular Interventions.....	207
<i>Sharan R. Ravigopal, Kirsten M. Williams, Jaydev P. Desai</i>	
Automatic Contact Force-Regulated End-Effector Using Pneumatic Actuator for Safe Robotic Ultrasound Imaging.....	214
<i>Wen-Yi Kuo, Xihan Ma, Dhirajsinh Deshmukh, Haichong K. Zhang</i>	
Brain-Mimicking Phantom for Photoablation and Visualization.....	220
<i>Ravi Prakash, Kent K. Yamamoto, Siobhan R. Oca, Weston Ross, Patrick J. Codd</i>	
User and Environmental Context Adaptive Knee Exoskeleton Assistance Using Electromyography .....	227
<i>Dawit Lee, Inseung Kang, Géza F. Kogler, Frank L. Hammond, Aaron J. Young</i>	
Towards In-Utero Navigational Assistance: A Multi Task Neural Network for Segmentation and Pose Estimation in Fetoscopy.....	233
<i>Mirza Awais Ahmad, Mouloud Ourak, Tom Vercauteren, Jan Deprest, Emmanuel Vander Poorten</i>	
Optical Fiber-Based Needle Shape Sensing: Three-Channel Single Core vs. Multicore Approaches* .....	239
<i>Alexandra Cheng, Dimitri A. Lezcano, Jin Seob Kim, Iulian I. Iordachita</i>	
Passive Model-Based Error Compensation for Beveled-Tip Needle Deflection .....	247
<i>Farid Tavakkolmoghaddam, Yang Wang, Charles Bales, Yiwei Jiang, Christopher Nyocz, Zhanyue Zhao, Gregory Fischer</i>	
Experimental Trials with a Shared Autonomy Controller Framework and the Da Vinci Research Kit: Pattern Cutting Tasks Using Thin Elastic Materials .....	254
<i>Paramjit Singh Baweja, Radian Gondokaryono, Lueder A. Kahrs</i>	
An Abdominal Phantom with Instrument Tracking for Laparoscopic Training .....	261
<i>Haochen Wei, Chi Chiung Grace Chen, Peter Kazanzides</i>	
Towards Reliable Colorectal Cancer Polyps Classification Via Vision Based Tactile Sensing and Confidence-Calibrated Neural Networks .....	267
<i>Siddhartha Kapuria, Tarunraj G. Mohanraj, Nethra Venkatayogi, Ozdemir Can Kara, Yuki Hirata, Patrick Minot, Ariel Kapusta, Naruhiko Ikoma, Farshid Alambeigi</i>	
Mixed Reality Based Teleoperation of Surgical Robotics .....	274
<i>An Chi Chen, Muhammad Hadi, Peter Kazanzides, Ehsan Azimi</i>	
Towards an MRI-Compatible Flexible Endoscopic Robot for Transsphenoidal Neurosurgery.....	281
<i>Boshen Qi, Hengjie Chen, Jason Langley, Behnam Badie, Xiaoping Hu, Jun Sheng</i>	
dVPose: Automated Data Collection and Dataset for 6D Pose Estimation of Robotic Surgical Instruments .....	288
<i>Nicholas Greene, Wenkai Luo, Peter Kazanzides</i>	
Design and Evaluation of a Flexible Sensorized Robotic OCT Neuroendoscope .....	295
<i>Junyan Yan, Peng Chen, Jibiao Chen, Jiaqi Xue, Chao Xu, Yufu Qiu, Haiyang Fang, Yiang Lu, George Kwok Chu Wong, Yun-Hui Liu, Wu Yuan, Shing Shin Cheng</i>	
Modelisation of a Human-Exoskeleton Interaction for Cerebral Palsy .....	302
<i>Aurélie Bonnefoy, Sabrina Otmani, Nicolas Mansard, Olivier Stasse, Guilhem Michon, Bruno Watier</i>	

A Trimodal Framework for Robot-Assisted Vascular Shunt Insertion When a Supervising Surgeon is Local, Remote, Or Unavailable .....	309
<i>Karthik Dharmarajan, Will Panitch, Baiyu Shi, Huang Huang, Lawrence Yunliang Chen, Thomas Low, Danyal Fer, Ken Goldberg</i>	
Enabling Higher Performance Concentric Tube Robots Via Multiple Constant-Curvature Tubes.....	317
<i>Alex Lu, Felipe Ramos, Jui-Te Lin, Tania K. Morimoto</i>	
Velocity Control for the Da Vinci Research Kit .....	324
<i>Jintan Zhang, Peter Kazanzides</i>	
Adaptive Lower-Limb Prosthetic Control: Towards Personalized Intent Recognition & Context Estimation.....	331
<i>C. Johnson, J. Cho, J. Maldonado-Contreras, S. Chaluvadi, A. J. Young</i>	

## **Author Index**