Monday 24th June 2019

08:30  Registration and Coffee

09:15  Welcome Address: Guang-Zhong Yang

Session 1 – Soft and Bioinspired Robot

Chairs: Pierre DuPont and Rick Satava

09:30  Keynote Lecture 1: Paolo Dario, The Scuola Superiore Sant’Anna, Pisa, Italy

*Bionics and Bioinspired Systems for Robotics*

10:15  Variable Contraction Timing for a Soft Robotic Cardiac Assist Device

C.J. Payne1,2, D. Van Story1,2, D. Bautista-Salinas2, M. Saeed2, T. Thalhofer1, P.J. del Nido2, C.J. Walsh1, N.V. Vasilyev2

1Wyss Institute for Biologically Inspired Engineering, Harvard University USA
2Department of Cardiac Surgery, Boston Children’s Hospital, USA

10:30  Evaluation of a Soft Helical Actuator Performance with Hard and Soft Attachments for Tissue Regeneration

Eduardo Perez-Guagnelli, Joanna Jones and Dana Damian

Sheffield Biomedical Robotics Lab, Automatic Control and Systems Engineering Department, University of Sheffield; UK

10:45  SoftSwitch: A soft Implantable Device for on/off Drug Release

Keegan Mendez1,2, William Whyte2,3, Garry P. Duffy3,4, Ellen T. Roche1,2,5

1Health Sciences and Technology, Massachusetts Institute of Technology, USA
2Institute for Medical Engineering and Science, Massachusetts Institute of Technology, USA
3Advanced Materials and Bio Engineering Research Centre, Trinity College Dublin, Ireland
4School of Medicine, National University of Ireland Galway, Ireland
5Department of Mechanical Engineering, Massachusetts Institute of Technology, USA

11:00  Eversion-type Soft Overtube for Minimally Invasive Surgery

F. Putzu, T. Abrar, J. Konstantinova, K. Althoefer

Centre for Advanced Robotics @ Queen Mary, UK

11:15  Design of a Robotic Balloon-catheter Endoscope for Sinus Procedures

Yingtian Li1, Reza Rahbar2, Pierre E. Dupont1

1Cardiovascular Surgery, Boston Children’s Hospital, Harvard Medical School, USA
### 11:30-12:00  Coffee Break

### 12.00  Poster Teaser Session 1

**Chairs: Jessica Burgner-Kahrs and Leonardo Mattos**

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<td>Estevan H. Murai¹, Daniel Martins¹, Pierre G. Silveira², Jian S. Dai³, Shervanthi Homer-Vanniasinkam⁴, Helge A. Wurdemann⁴</td>
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<tr>
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<td>¹Mechanical Engineering, Federal University of Santa Catarina, Florianópolis, Brazil</td>
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<td>²Surgery Department, Federal University of Santa Catarina, Florianópolis, Brazil</td>
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<td>³Department of Informatics, King’s College London, UK</td>
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<td>⁴Department of Mechanical Engineering, University College London, UK</td>
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<td>He Liu, Ferdinando Rodriguez y Baena</td>
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<td><em>Mechatronics in Medicine Laboratory, Imperial College London, UK</em></td>
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<td>Y. Sevimli¹, D. Levi¹, A. Bhat¹, O. Puleo¹, R.H. Taylor², D. Saunders¹</td>
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<td>¹Galen Robotics, Inc., USA</td>
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<td>²Laboratory for Computational Sensing and Robotics, Johns Hopkins University, USA</td>
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<td>Gustavo D. Gil¹, Julie M. Walker², Nabil Zemiti¹, Allison M. Okamura², Philippe Poignet¹</td>
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<td>¹LIRMM, University of Montpellier, CNRS, Montpellier, France</td>
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<td>²Department of Mechanical Engineering, Stanford University, Stanford, USA</td>
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<td>C. D’Ettorre³, A. Stilli³, G. Dwyer³, M. Tran² and D. Stoyanov¹</td>
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<td>¹Wellcome/ EPSRC Centre for Interventional and Surgical Science (WEISS), UCL, UK</td>
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<td>²Research Department of Surgical Biotechnology, University College London, UK</td>
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<td>¹University of Naples Federico II, Italy</td>
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<td>²University of Campania “Luigi Vanvitelli”, Italy</td>
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<td>Hirenkumar Nakawala, Paolo Fiorini</td>
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<td><em>Department of Computer Science, University of Verona, Verona, Italy</em></td>
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<th>P8</th>
<th>Deployable Shape Sensors for Minimally Invasive Surgery Using Frequency</th>
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Division Multiplexed Electrical Impedance Tomography
J Avery¹, M Runciman⁵, G Mylonas², A Darzi¹
¹Department of Surgery and Cancer, Imperial College London, London, UK,
²HARMS Lab, Department of Surgery and Cancer, Imperial College London, UK

P9 Real-time Prediction of Breast Lesions Displacement during Ultrasound Scanning Using a Position-based Dynamics Approach
D. Dall’Alba¹, E. Tagliabue¹, E. Magnabosco¹, C. Tenga¹, P. Fiorini¹
¹Dept. of Computer Science, University of Verona, Italy

P10 Needle Segmentation in 3D Ultrasound Volumes Based on Machine Learning for Needle Steering
G. Lapouge¹–², H. Younes¹, P. Poignet², S. Voros³, J. Troccaz¹
¹Univ. Grenoble Alpes, CNRS, Grenoble INP, TIMC-IMAG, F-38000 Grenoble, France
²Univ. Montpellier, CNRS, LIRMM, F-34090 Montpellier, France

P11 Robotically Assisted Electrical Bio-impedance Measurements for Soft Tissue Characterization: a Feasibility Study
Kim L. Schwaner¹, Diego Dall’Alba², Zhuoqi Cheng³, Leonardo S. Mattos³, Paolo Fiorini² and Thiusius R. Savarimuthu¹
¹The Maersk Mc-Kinney Møller Institute, University of Southern Denmark, Denmark
²Department of Computer Science, University of Verona, Italy
³Department of Advanced Robotics, Istituto Italiano di Tecnologia, Italy

P12 Surgical Action Recognition with Spatiotemporal Convolutional Neural Networks
Giacomo De Rossi¹, Nicola Piccinelli¹, Francesco Setti¹, Riccardo Muradore¹, Fabio Cuzzolin²
¹University of Verona, Italy
²Oxford Brookes University, UK

P13 Deep Q Reinforcement Learning for Autonomous Navigation of Surgical Snake Robot in Confined Spaces
S. Athiniotis, R. A. Srivatsan and H. Choset
Robotics Institute, Carnegie Mellon University, USA

P14 Autonomous Detection of C. diff Toxins in Clinical Stool Using A Magnetic Microrobotic System
Lidong Yang, Yabin Zhang, and Li Zhang
Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong (CUHK), Shatin NT, Hong Kong SAR, China

P15 Gaze-contingent Robotic Flexible Endoscopy
A. A. Kogkas¹, B. Glover¹, N. Patel¹, A. Darzi¹, G. P. Mylonas¹
¹HARMS Lab, Department of Surgery and Cancer, Imperial College London, UK
²Department of Surgery and Cancer, Imperial College London, UK
³Department of Gastroenterology, Imperial College London, UK

P16 Wave-shape Notched Compliant Joint with High Rigidity
Seunguk Kim¹, Seongbo Shim¹, Daekun Ji¹ and Jaesung Hong¹
Estimating the Complete Shape of Concentric Tube Robots via Learning
A. Kuntz, A. Sethi, R. Alterovitz
Department of Computer Science, University of North Carolina at Chapel Hill, USA

Design and Modelling of a Multi-segment Steerable Sheath for Single-port Endoscopic Procedures
Jiaole Wang1, Pierre E. Dupont1
1Boston Children’s Hospital, Harvard Medical School, Boston, USA

Vessel Reconstruction Using Multiple Forward-looking Sensors in a Steerable Needle
Vani Virdyawan1, and Ferdinando Rodriguez y Baena1
1Department of Mechanical Engineering, Imperial College London, UK

Semi-analytical Orientation Alignment with Joint Limit Constraints for Teleoperated Surgical System
Yuanpei Cai1, C. W. Vincent Hui1, and K. W. Samuel Au1
1Dept. of Mechanical & Auto. Eng., The Chinese University of Hong Kong, China

Soft, Deployable, Cable Driven Robot for Minimally Invasive Surgery
Mark Runciman1*, James Avery2, Ming Zhao1, Ara Darzi1, George Mylonas1
1HARMS Lab, Department of Surgery and Cancer, Imperial College London, UK
2Department of Surgery and Cancer, Imperial College London, UK

Design of Non-circular Joint Contour for Continuum Robots
Z. Jin1, A. Gao1, N. Liu1, Z. Wu1, G. Z. Yang1
1The Hamlyn Centre for Robotic Surgery, Imperial College London, UK

Ultrasound-based Safety Assessment during Moving Organ Tracking Towards In vivo Focused Ultrasound Therapy
A. Mariani1, L. Morchi1, A. Diodato, A. Cafarelli, S. Tognarelli, A. Menciassi
The BioRobotics Institute, Sant’Anna School of Advanced Studies, Pisa, Italy

Identification of the Electrocautery State to Enable Spatially Navigated Intraoperative Mass Spectrometry Tissue Analysis
M. Asselin1, A. Jamzad1, A. Lasso1, T. Ungi1, J. Rudan2, G. Fichtinger1,2
1Laboratory for Percutaneous Surgery, School of Computing, Queen’s University, Canada
2Department of Surgery, School of Medicine, Queen’s University, Canada

Preliminary Validation of Urethral Transection Simulation during RARP
Julien Abinahed1, Nikhil Navkar1, Georges Younes1, Shidin Balakrishnan1, Abdulrahman Alfayad1, Waseem Pallyali1, Gorune Ohannessian1, Zherong Pan3, Dinesh Manocha4, George Turkiyyah3, and Abdulla Al-Ansari1
1Department of Surgery, Hamad Medical Corporation, Qatar
2Department of Computer Science, American University of Beirut, Lebanon
3Department of Computer Science, University of North Carolina, USA
4Department of Computer Science, University of Maryland, USA
P26 Towards Smart Oxygenation Sensing Implants Using Soft Robotics and Diffuse Reflectance Spectroscopy
J Avery¹, M Runciman², A J Thompson¹, G Mylonas³, A Darzi¹
¹Department of Surgery and Cancer, Imperial College London, London, UK,
²HARMS Lab, Department of Surgery and Cancer, Imperial College London, UK

P27 Layer Jamming Pneumatic Actuator for Medical Robotics
Michele Ibrahimi, Linda Paternò, Leonardo Ricotti, Arianna Menciassi
The BioRobotics Institute, Scuola Superiore Sant’Anna, Pisa, Italy

P28 Gaze-contingent Robotic Nurse Assistant
A. A. Kogkas¹, A. Ezzat¹, R. Thakkar³, A. Darzi², G. P. Mylonas¹
¹HARMS Lab, Department of Surgery and Cancer, Imperial College London, UK
²Department of Surgery and Cancer, Imperial College London, UK
³St George’s, University of London, UK

P29 Towards Semi-automated Mechanical Thrombectomy: Path Planning Considerations for a Double Articulated Microcatheter
Colette Abah¹, Giuseppe Del Giudice¹, Neel Shihora³, Rohan Chitale², Nabil Simaan¹
¹Department of Mechanical Engineering, Vanderbilt University, Nashville TN, USA
²Department of Neurological Surgery, Vanderbilt University Medical Centre, USA

P30 A Low-cost Draw-wire Sensor for Kinematic Sensing in Wearable Assistive Robots
R. J. Varghese, R. K. Singh, J. Liu, G-Z. Yang
The Hamlyn Centre, Institute for Global Health Innovation, Imperial College London, UK

P31 A Novel Hybrid Master-slave Control Interface for Surgical Robot Remote Control
Junhong Chen¹**, Dan-Dan Zhang¹**, Wuzhou Hong², Jindong Liu¹, Guang-Zhong Yang¹
¹Hamlyn Centre for Robotic Surgery, Imperial College London, UK
²Shanghai Jiao Tong University, China

P32 Design of Master Device Featured Redundant Joint for 4-DOFs Slave of Flexible Surgery Robot
Jeongdo Ahn¹, Dong-Soo Kwon¹
¹Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology (KAIST), Korea

13:00-14:00 Lunch

Session 2 – Clinical Translation and Challenges

Chairs: Russ Taylor and Paolo Fiorini

14:00 Karl Storz - Harold Hopkins Golden Telescope Lecture:
Dinesh Nathwani, Imperial College London, UK

An Orthopaedic Journey from Navigation to Robotics:
Is this Finally the Moment for Surgical Revolution
14:45  
Jimmy Da Silva¹², Thibault Chandanson¹, Guillaume Morel²  
¹SpineGuard, Vincennes, France  
²Sorbonne Université, CNRS, INSERM, ISIR – Paris, France

15:00  
**Intraoperative Robotics for Patient Specific Instrument Manufacture: a Cadaver Trial**  
A. Darwood¹, S. Hurst¹, G. Villatte², R. Fenton³, F. Tatti¹, H. El-Daou¹, P., Reily¹, R. Emery¹, F. Rodriguez y Baena³  
¹Imperial College London, UK  
²Centre Hospitalier Universitaire de Clermont-Ferrand, France  
³Desoutter Medical Ltd, UK

15:15  
**Simulation-based Adaptive Training for Robot-assisted Surgery: a Feasibility Study on Medical Residents**  
A. Mariani¹², E. Pellegrini¹, A. Menciassi², and E. De Momi¹  
¹Department of Electronics, Information and Bioengineering, Politecnico di Milano, Italy  
²The BioRobotics Institute, Sant’Anna School of Advanced Studies, Pisa, Italy

15:30  
**Robot-assisted Surgical Training Over Several Days in a Virtual Surgical Environment with Divergent and Convergent Force Fields**  
Y. A. Oquendo¹, Z. Chua¹, M. M. Coad², I. Nisky³, A. Jarc³, S. Wren¹, T.S. Lendvay⁴, A. M. Okamura¹  
¹Stanford University, USA  
²Ben-Gurion University of the Negev, Israel  
³Intuitive Surgical, USA  
⁴University of Washington, USA

15:45-16:15  
**Coffee Break**

**Session 3 – Wearable Robotics and VR in Surgical Training**

*Chairs: Simon DiMaio and Gabor Fichtinger*

16:15  
**Keynote Lecture 2: Conor Walsh, Harvard University, USA**  
*Soft Wearable Robots for Everyday Wear*

17:00  
**A Musculoskeletal Modelling-based Prototyping Platform for a Tremor Suppression Exo-Glove**  
X. Chen*, R. J. Varghese*, A. Barbot, S. Anastasova, G-Z. Yang  
The Hamlyn Centre, Institute for Global Health Innovation, Imperial College London, UK

17:15  
**Assisting Hand Movement of TBI Patients Through Robotic Orthoses**  
T. Meier¹, P. A. Carvalho², K. Y. Gandomi³, G. S. Fischer³, and C. J. Nycz¹*
17:30  Reciprocal Kinematic Control: Using Human-robot Dual Adaptation to Control Upper Limb Assistive Devices
M. Legrand\textsuperscript{1}, E. de Montalivet\textsuperscript{1}, F. Richer\textsuperscript{1}, N. Jarrassé\textsuperscript{1}, G. Morel\textsuperscript{1}
\textsuperscript{1}Sorbonne University, CNRS, UMR 7222 / INSERM, ISIR- Agathe, Paris, France

17:45  Virtual Reality Training in Robot-assisted Surgery: a Novel Experimental Setup for Skill Transfer Evaluation
Guido Caccianiga\textsuperscript{1,2}, Andrea Mariani\textsuperscript{2}, Elena De Momi\textsuperscript{2}, Jeremy D. Brown\textsuperscript{1}
\textsuperscript{1}Johns Hopkins University, Baltimore, Maryland, USA
\textsuperscript{2}Politecnico di Milano, Milano, Italy

18:00  SlicerVR for image-guided Therapy Planning in Immersive Virtual Reality
Csaba Pinter\textsuperscript{1}, Andras Lasso\textsuperscript{1}, Mark Asselin\textsuperscript{1}, Jean-Christophe Fillion-Robin\textsuperscript{2}, Jean-Baptiste Vimort\textsuperscript{2}, Ken Martin\textsuperscript{2}, Gabor Fichtinger\textsuperscript{1}
\textsuperscript{1}Laboratory for Percutaneous Surgery, Queen’s University, Kingston, Canada
\textsuperscript{2}Kitware Incorporated, Carrboro, North Carolina, USA

18:15  dVRK-XR: Mixed Reality Extension for Da Vinci Research Kit
Long Qian, Anton Deguet and Peter Kazanzides
Laboratory for Computational Sensing and Robotics, Johns Hopkins University, USA

18:30  Drinks Reception and Poster Session

19:15  Programme Committee Dinner (Invitation Only)
Venue: 170 Queen’s Gate, Kensington, London
Tuesday 25th June 2019

08:30 Registration and Coffee

Session 4 – Imaging and Emerging Surgical Systems

Chairs: Bradley Nelson and Ichiro Sakuma

09:00 Feasibility of Volumetric OCT Imaging Using Continuum Robots with Equilibrium Modulation
Giuseppe Del Giudice¹, Jin-Hui Shen², Karen Joos², Nabil Simaan³
¹Department of Mechanical Engineering, Vanderbilt University, Nashville TN, USA
²Vanderbilt Eye Institute, Vanderbilt University Medical Centre, Nashville TN, USA

09:15 A Flexible Endoscopic Robotic Suturing System for Gastrointestinal Perforations: Animal Study
L. Cao¹, X. Li¹, P. T. Phan¹, A. M. H. Tiong¹, H. L. Kaan²
K. Y. Ho³, P. W. Y. Chiu³, S. J. Phee⁴
¹Robotics Research Centre, Nanyang Technological University, Singapore
²Department of Surgery, National University Hospital, Singapore
³Yong Loo Lin School of Medicine, National University of Singapore, Singapore

09:30 Development of a Robotic Endoscope Automated via Laryngeal Imaging for Tracheal Intubation (REALITI)
Q. Boehler¹, P. Hofmann, D. Gage², A. Gehring, C. Chautems¹,
P. Biro³, B.J. Nelson¹
¹Multi-Scale Robotics Lab, ETH Zurich, Switzerland
²University of Zurich, Switzerland
³Institute of Anaesthesiology, University Hospital Zurich, Switzerland

09:45 Towards Robotic Cleft Palate Repair: Teleoperated Suturing with a 3mm Pin-jointed Wrist on the da Vinci Research Kit
G. Wu¹,², D. Podolsky², N. Hussein³, M. Mikic¹,², T. Looi¹, C.R. Forrest², J.M. Drake¹,²
¹Center for Image Guided Innovation and Therapeutic Intervention, Sick Kids Hospital, Canada
²Institute of Biomaterials and Biomedical Engineering or Department of Surgery, University of Toronto, Canada

10:00 Prototype Designs of a Cable-driven Parallel Robot for Transoral Laser Surgery
M. Zhao, T.J.C. Oude Vrielink, A.A. Kogkas, D.S. Elson, G.P. Mylonas
Department of Surgery and Cancer, Imperial College London, UK

10:15 Challenges of Autonomous Surgical Robotics
P. Fiorini, D. Dall’Alba, M. Ginesi, B. Maris, D. Meli, H. Nakawala, A. Roberti, E. Tagliabue
Department of Computer Science, University of Verona, Italy
10:30  Keynote Lecture 3: Alexander Meining, University of Würzburg, Germany  
*Future Trends in Interventional Gastrointestinal Endoscopy*

11:15-11:45  Coffee Break

**Session 5 – Smart Handheld devices**

*Chairs: Howie Choset and Dennis Fowler*

11:45  **Hand-held Stiffness Measurement Device for Tissue Analysis**  
T. A. Zodage¹, A. N. Chaudhury², R. A. Srivatsan², N. Zevallos², H. Choset²  
¹Mechanical Engineering, BITS Pilani, India  
²Robotics Institute, Carnegie Mellon University, USA

12:00  **Admittance Control of a Handheld Microsurgical Instrument**  
G. Russo¹, S. Moccia²,³, J. N. Martel⁴, A. Perin⁵, R. F. Sekula⁶, L. Bascetta¹  
¹Dept. of Electronics, Information and Bioengineering, Politecnico di Milano, Milan, Italy  
²Department of Advanced Robotics, Istituto Italiano di Tecnologia, Genoa, Italy  
³Department of Information Engineering, Università Politecnica delle Marche, Ancona, Italy  
⁴Department of Ophthalmology, University of Pittsburgh, Pittsburgh, USA  
⁵Besta NeuroSim Center, IRCCS Istituto Neurologico C. Besta, Milan, Italy  
⁶Department of Neurological Surgery, University of Pittsburgh, Pittsburgh, USA  
The Robotics Institute, Carnegie Mellon University, Pittsburgh, USA

12:15  **Tremor Reduction Using Time Delay Estimation on Handheld Microsurgical Device**  
Jintaek Im, Sukho Park, Cheol Song  
Department of Robotics Engineering, DGIST, Daegu, Korea

12:30  **Development of 5-DOFs Master-slave System with Intentional Adjustment of Hysteresis Based on Antagonistic Tendon Control**  
Hansoul Kim¹, Joonhwan Kim², Minho Hwang³, Dong-Soo Kwon²*  
¹Robotics Program, KAIST, Daejeon, 305-701, Korea  
²Department of Mechanical Engineering, KAIST, Daejeon, 305-701, Korea

12:45  **Quantifying the Benefits of Robotic Assistance in Various Microsurgical Procedures**  
Olivia Puleo¹, Yunus Sevimli¹, David Levi¹, Ashwin Bhat¹, David Saunders¹, Russell H. Taylor²  
¹Galen Robotics, Inc., USA  
²Laboratory for Computational Sensing and Robotics, Johns Hopkins University, USA

13:00-14:00  Lunch
14:00-14:30  Translational Keynote: Moshe Shoham, Technion – Israel Institute of Technology, Israel
   On the Horizon of Medical/Surgical Robots

14:30  The Leaders’ Forum on Technology Application in Clinical Practice

15:30-16:00  Coffee Break

16:00  Challenge and Highlights
   Chairs: Bob Webster and Robert Merrifield

16:00  Surgical Robot Challenge Highlights

16:30  Closing Keynote Lecture: John Rogers, Northwestern University, USA
   Soft Electronics for the Human Body

17:15  Best Paper Rewards
   Chairs: Prof Guang-Zhong Yang and Prof Ara Darzi and representatives of the Helen Hamlyn Trust