



Programme

The Hamlyn Symposium on Medical Robotics

The Hamlyn Symposium on Medical Robotics

22nd-25th June, 2013, The Royal Academy of Engineering and Imperial College,
London, UK

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The Royal Academy of Engineering and Imperial College,
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www.hamlyn-robotics.org

Sunday 23rd June 2013

08:45 Registration and Coffee

09:15 Welcome (*Ara Darzi*)

Session 1 - Platform Design

Chairs: Yulun Wang, Dennis Fowler

09:30 **Invited Lecture: Robert D. Howe, Harvard University**
Cardiac Surgical Planning through Imaging and Mechanics

10:15 **Design of a Bone-Attached Robot for Mastoidectomy**
N.P. Dillon^{*1}, R.J. Webster III^{1,2}, T.J. Withrow¹
¹*Department of Mechanical Engineering, Vanderbilt University*
²*Department of Otolaryngology, Vanderbilt University Medical Center*

10:30 **Achieving Biocompatibility in Soft Sensors for Surgical Robots**
A. Gosline*, V. Arabagi, A. Kassam, P.E. DuPont
Boston Children's Hospital, Harvard Medical School, USA

10:45 **3D Ultrasound-Guided Retrieval of Foreign Bodies from a Beating Heart using a Dextrous Surgical Robot**
P. Thienphrapa¹, A. Popovic², R.H. Taylor^{*1},
¹*ERC CISST/LCSR, Johns Hopkins University, USA*
²*Philips Research North America, USA*

11:00 **Virtobot-Robot System in Forensic Medicine**
W. Ptacek¹, L. Ebert², M. Fürst¹, R. Breitbeck², M. Thali², G. Kronreif^{*1}
¹*ACMIT- Austrian Center for Medical Innovation and Technology, Integrated Microsystems Austria GmbH, Austria*
²*Institute of Forensic Medicine, University of Zurich, 8057 Zurich, Switzerland*

11:15 Coffee Break and Poster Session

Chair: Kevin Cleary; Conveyor: George Mylonas

11:45 **Poster Teasers Session 1 (3 minute presentations)**

P1 **ASTRO: A Novel Robotic Tool for Laser Surgery of the Prostate**
S. Russo*, P. Dario, A. Menciassi
The Biorobotics Institute, Scuola Superiore, Sant'Anna, Italy



- P2 Improvement of Target Registration Accuracy with Anatomical Landmarks**
J. Chien¹, J. Park², S. Jeon¹, J. Hong*¹
¹*Department of Robotics Engineering, Daegu Gyeongbuk Institute of Science and Technology, Daegu, Korea*
²*Kyungpook National University, Medical Device and Robot Institute of Park, Korea*
- P3 Towards an Endoscopic Device for Laser-Assisted Phonomicrosurgery**
D. Kundrat*, A. Schoob, B. Munske, T. Ortmaier
Institute of Mechatronic Systems, Leibniz Universitat, Hannover, Germany
- P4 Accurate Dense Feature Matching in Endoscopic Videos**
G.-L. Mariottini*, G.A. Puerto-Souza
Department of Computer Science and Engineering, University of Texas, Arlington, USA
- P5 Multimodal Reconstruction for Image-Guided Interventions**
P. Pratt*¹, A. Hughes-Hallett¹, A. di Marco¹, T.P. Cundy¹, E. Mayer², J. Vale², A. Darzi¹, G.-Z. Yang¹
¹*Hamlyn Centre for Robotic Surgery, Imperial College London, UK*
²*Department of Surgery and Cancer, Imperial College London, UK*
- P6 Towards an Ontology for Orthopaedic Surgery, Application to Hip Resurfacing**
P.J.S. Gonçalves*^{1,2}
¹*Polytechnic Institute of Castelo Branco (IPCB), Portugal,*
²*Instituto Superior Técnico, Univ Tec de Lisboa, IDMEC, LAETA, Lisbon, Portugal*
- P7 Ex-vivo Robotic Trials for Thyroidectomy with Novel Retraction**
A. Arora*¹, N. Tolley¹, Z. Awad², V. Luzzato², M. Oldfield², F. Rodriguez y Baena²
¹*Department of Otolaryngology, St Mary's Hospital, Imperial College Healthcare NHS Trust, London, UK*
²*Department of Mechanical Engineering, Imperial College London, UK*
- P8 Automated Cognitive Load Detection with Electroencephalography: Towards Brain-Computer Interfacing in Robotic Surgery**
K. Shetty*¹, T. Zander², D.R. Leff¹, R. Lorenz², G.-Z. Yang¹, A. Darzi¹
¹*The Hamlyn Centre for Robotic Surgery, Imperial College London, UK*
²*Department of Biological Psychology and Neuroergonomics, Team PhyPA, TU Berlin, Germany*
- P9 Vibration-Induced Frictional Reduction for Magnetically Guided Intracorporeal Devices**
M. Sfakiotakis^{1,2}, N. Pateromichelakis¹, D.P. Tsakiris*¹
¹*Institute of Computer Science, Foundation for Research and Technology, Hellas, Greece*
²*Department of Electrical Engineering, Technological Educational Institute of Crete, Greece*



- P10 Multispectral Imaging using a Fast Filter Wheel System during Vascular Surgery**
N.T. Clancy*^{1,2}, M. Ebner³, J.S. Crane², R. Corbett⁴, N. Duncan⁴, C. Caro⁵, D.S. Elson^{1,2}
¹The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
²Department of Surgery and Cancer, Imperial College London, UK
³Karl-Storz GmbH & Co., Tuttlingen, Germany
⁴Department of Medicine, Imperial College London, UK
⁵Department of Bioengineering, Imperial College London, UK
- P11 Surgical Instrument Forces Exerted during Robot-Assisted Neurosurgery: A Cadaver Study**
H.J. Marcus*¹, K. Zareinia², L.S. Gan², F. Yang², S. Lama², G.-Z. Yang¹, G. Sutherland²
¹The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
²Department of Clinical Neurosciences, University of Calgary, Canada
- P12 New Solution for Solid-Organ Resection Based on a Compact MIS Robot**
J.M. Li*¹, N.X. Zhou², L.A. Zhang¹, Y. Chen¹, S.X. Wang¹
¹Key Lab for Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, Tianjin, China
²Hepatobiliary Gastroenterology Institute, PLA 2nd Artillery General Hospital, Beijing, China
- P13 A Fault Analysis Procedure for Surgical Robotic Systems**
M. Capiluppi*¹, L. Schreiter², P. Fiorini¹, J. Raczowsky², H. Woern²
¹University of Verona, Italy
²Karlsruhe Institute of Technology, Germany
- P14 Real-Time Visual Stiffness Feedback for Soft Tissue Palpation in a Telemanipulation Environment**
M. Li*¹, J. Konstantinova¹, V. Aminzadeh¹, T. Nanayakkara¹, L. D. Seneviratne¹, P. Dasgupta², K. Althoefer¹
¹Centre for Robotics Research, King's College of London, UK
²MRC Centre for Transplantation, DTIMB and NIHR BRC, King's College London, UK
- P15 Detection and Identification of Multispectral Structured Light Patterns for Minimally Invasive Surgery**
J. Lin*¹, N. T. Clancy^{1,2}, G. Boissonnat³, D.S. Elson^{1,2}
¹Hamlyn Centre for Robotic Surgery, Imperial College London, UK
²Department of Surgery and Cancer, Imperial College London, UK
³Department of Bioengineering, Imperial College London, UK
- P16 Hand Exoskeleton for Remote Control of Minimally Invasive Surgical Anthropomorphic Instrumentation**
A. Tzemanaki*^{1,2}, X. Gao², A. Pipe^{1,2}, C. Melhuish¹, S. Dogramadzi^{1,2}
¹Bristol Robotics Laboratory, UK
²University of the West of England, UK



- P17 **Embedded Middleware and Hard Real-Time Based Architecture for Robot Assisted Ophthalmic Surgery**
S. Nair¹, M. Ali Nasser¹, M. Eder¹, C. P. Lohmann² and A. Knoll¹
¹Robotics and Embedded Systems, Technische Universitaet Muenchen, Germany
²Klinikum Rechts der Isar, Technische Universitaet Muenchen, Germany
- P18 **Application of Robot-Assisted Laparoscopic Surgery in Paediatric Urology – A Seven-Year Single Surgeon Experience**
T.P. Cundy¹, N.E. Gattas², S.M. Whiteley², A. Springer², A.S. Najmaldin²
¹The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
²Department of Paediatric Surgery, Leeds General Infirmary, UK
- P19 **Case-Specific Rehearsal Using a Temporal Bone Simulator: Is it Feasible and Clinically Applicable?**
A. Arora¹, C. Swords¹, S. Khemani², Z. Awad¹, A. Darzi³, A. Singh⁴, N. Tolley¹
¹Department of Otolaryngology, St. Mary's Hospital, Imperial College NHS Trust, London UK
²Department of Otolaryngology, Surrey and Sussex NHS Trust, UK
³Department of Biosurgery and Surgical Technology, Imperial College London, UK
⁴Department of Otolaryngology, Northwick Park NHS Trust, London, UK

12:45 Lunch and Poster Session

Session 2 - Image Guidance In Robotic Surgery

Chairs: Russ Taylor, Kirby Vosburgh

14:30 Invited Lecture: Reiza Rayman, Titan Medical Inc.
The Next Generation of Surgical Robots: What Do We Need

15:15 Robotic, Registered, Transrectal Ultrasound Guidance during da Vinci Radical Prostatectomy: Initial Clinical Experience
O. Mohareri¹, J. Ischia², C. Schneider¹, P. Black² and S.E. Salcudean¹
¹Department of Electrical and Computer Engineering, University of British Columbia, Canada
²Department of Urologic Sciences, Faculty of Medicine, University of British Columbia, Canada

15:30 Backlash Compensation Method for Wire Drive Forceps Mechanism Under Various Loading Conditions
I. Sakuma*, Y. Tsukahara, T. Ando, H. Liao, E. Kobayashi
School of Engineering, The University of Tokyo, Japan

15:45 A Dexterous Instrument for Minimally Invasive Neurosurgery
F. Khan*, B. Carrillo, T. Looi, J. Drake
Centre for Image Guided Intervention and Therapeutic Innovation, The Hospital for Sick Children, Toronto, Canada



- 16:00** **Image Guided and Robotic Assisted Minimally Invasive Cochlear Implantation**
S. Weber¹, N. Gerber¹, K.A. Gavaghan*¹, T. Williamson¹, W. Wimmer¹, J. Ansó¹, L. Brogna-Salas¹, D. Chen¹, C. Weisstanner², M. Caversaccio³, B. Bell¹
¹ARTORG Centre for Biomedical Engineering Research, University of Bern, Switzerland
²Institute of Diagnostic and Interventional Neuroradiology, University Hospital of Bern, Switzerland
³Department of ENT surgery, University Hospital of Bern, Switzerland

16:15 **Coffee Break and Poster Session**

Session 3 - Training and Clinical Outcomes

Chairs: Pierre Dupont, Leo Joskowicz

- 16:45** **A Filtering Approach for Surgical Registration with Unknown Stiffness**
S. Tully¹, A. Bajo², N. Simaan², H. Choset*¹
¹The Robotics Institute, Carnegie Mellon University, USA
²Mechanical Engineering, Vanderbilt University, USA
- 17:00** **Per-Oral Endoscopic Cardiomyotomy and Pyloromyotomy using a Flexible Snake Robot – Proof of Concept with a Porcine Model**
T.P. Cundy*, N.K. Patel, J. Shang, C.A. Seneci, C.J. Payne, V. Vitiello, J. Clark, J.P. Teare, A. Darzi, G.-Z. Yang
The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
- 17:15** **Mechanical Drive System for Enhancing Flexible Endoscopy: System Concept and Prototype Development**
L. Zhang^{1,2}, R. Khare¹, E. Wilson¹, A. Martin¹, K. Wu¹, K. Swords¹, K. Cleary*¹, C.A. Peters¹
¹Sheikh Zayed Institute for Paediatric Surgical Innovation, Children's National Medical Centre, Washington, USA
²Tianjin University, Tianjin, China
- 17:30** **SINGER: A Virtual Simulator for Robotic Neurosurgery**
M. Niccolini¹, C. Diversi^{1,2}, B. Kang*^{1,2}, V. Castelli^{1,2}, B. Mazzolai¹, E. Sinibaldi¹
¹Center for Micro-BioRobotics@SSSA, Istituto Italiano di Tecnologia, Italy
²The Biorobotics Institute, Scuola Superiore S. Anna, Italy

18:30 **Dinner for Programme Committee Members**

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Monday 24th June

08:45 Registration and Coffee

Session 4 - New Clinical Approaches and Pilot Studies

Chairs: Rick Satava, Azad Najmaldin

09:15 Keynote Lecture: Gary Guthart, Intuitive Surgical
The daVinci System at 14: Clinical Overview, Economics and Opportunities

10:00 Trans-Nasal Robotic Micro-Surgery of the Throat: A Cadaveric Feasibility Study

A. Bajo¹, L.M. Dharamsi², J.L. Netterville², C.G. Garrett², N. Simaan*¹

¹*Department of Mechanical Engineering, Vanderbilt University, Nashville TN, USA*

²*Department of Otolaryngology, Vanderbilt University Medical Center, Nashville TN, USA*

10:15 Implanted Miniature Engineering Mechanisms in Tendon-Transfer Surgery Improves Robustness of Post-Surgery Hand Function

R. Balasubramanian*¹, J. Montgomery¹, K. Mardula¹, C. Allan²

¹*Oregon State University, USA*

²*University of Washington, USA*

10:30 First Evaluations in the Control of a Novel Flexible Surgical Robot

A. de Donno*, L. Zorn, P. Zanne, F. Nageotte, M. de Mathelin

ICube, University of Strasbourg, CNRS, France

10:45 Nanoparticle Ferrofluids for Tissue Manipulations in Minimal Access Surgery

Y.S. Lin*, R. Roshan, P. Culmer, T. Liskiewicz, A. Neville

Institute of Engineering Thermofluids, Surfaces and Interfaces, University of Leeds, UK

11:00 Coffee Break and Poster Session

11:30 Poster Teasers Session 2 (3 minute presentations)

Chair: Julian Teare; Conveyors: Mikael Sodergren, Dan Leff

P20 Development of Robot-Assisted Surgery in Qatar

O. Al-Alao*¹, J.-M. Peyrat², J. Abi-Nahed², A. Al-Ansari^{1,2}

¹*Hamad Medical Corporation, Qatar*

²*Qatar Robotic Surgery Centre, QSTP, Qatar*



- P21 **Operative Working Spaces in Keyhole Neurosurgery: An MRI Study**
H.J. Marcus*¹, A. Hughes-Hallett¹, P. Pratt¹, J. Clark¹, D. Nandi², A. Darzi¹, G.-Z. Yang¹
¹*The Hamlyn Centre for Robotic Surgery, Imperial College London, UK*
²*Department of Neurosurgery, Imperial College Healthcare NHS Trust, UK*
- P22 **Developing a Training Tool for Intraoperative Mitral Valve Analysis**
N.A. Tenenholtz*, R.D. Howe
School of Engineering and Applied Sciences, Harvard University, USA
- P23 **Anatomical Neck Dissection for Real Time Intraoperative in-Vivo in-Situ Soft Tissue Morphology Characterisation using Confocal Endomicroscopy**
T.-P. Chang*, K. Sriskandarajah, T.P. Cundy, D.R. Leff, R. C. Newton, H.J. Marcus, A. Darzi, G.-Z. Yang
The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
- P24 **Pre-clinical Validation and Assessment of an Innovative Bi-Manual Surgical Robot for Single-Port Laparoscopy**
G. Petroni*, M. Niccolini, S. Tognarelli, C. Quaglia, S. Caccavaro, A. Menciassi, P. Dario
The Biorobotics Institute, Scuola Superiore Sant'Anna, Italy
- P25 **Image Guidance Framework with Endoscopic Video for Automated Robotic Anastomosis in a Paediatric Setting**
T. Looi*¹, B. Yeung², M. Umasuthan², J.M. Drake¹
¹*The Hospital for Sick Children, Toronto, Canada*
²*MDA Corporation, Brampton, Canada*
- P26 **Robotic Thyroidectomy: A Prospective Case Control Study**
A. Arora*¹, S. Sharma¹, K. Muthuswamy¹, Z. Awad¹, J. Budge¹, A. Darzi², F. Palazzo¹, N.Tolley¹
¹*Department of Endocrine and Thyroid Surgery, Imperial College Healthcare NHS Trust, UK*
²*Department of Biosurgery and Surgical Technology, Imperial College London, UK*
- P27 **Design and FEM Simulation of a Miniaturised Wristed Surgical Grasper**
C.A. Seneci*, J. Shang, G.-Z. Yang
The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
- P28 **A Bio-Galvanic Approach to Tissue Characterisation: Technological Considerations**
J.H. Chandler*¹, A. Hood, P.R. Culmer¹, D. Jayne², A. Neville¹
¹*School of Mechanical Engineering, University of Leeds, UK*
²*Leeds Academic Surgical Unit, St James' University Hospital, UK*
- P29 **Gesture Based Gaze Contingent Control of a Robotic Arm for Laparoscopic Applications**
K. Fujii*, A. Salerno, K. Sriskandarajah, K.-W. Kwok, G.-Z. Yang
The Hamlyn Centre for Robotic Surgery, Imperial College London, UK



- P30 **Video-Based Framework for Safer and Smarter Computer Aided Surgery**
S. Kumar¹, M.S. Narayanan², S. Misra, S. Garimella¹, P. Singha¹, J.J. Corso¹, V. Krovi*¹
¹*School of Engineering & Applied Sciences, University of Buffalo (SUNY), Buffalo, USA*
²*School of Medicine and Biomedical Science, University of Buffalo (SUNY), Buffalo, USA*
- P31 **Performance and Eye Behaviour Changes Associated with Visuomotor Rotation – Relevance for Design of Robotic Telemanipulators**
K. Sriskandarajah*, K. Shetty, M. Sodergren, G.-Z. Yang, A. Darzi
The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
- P32 **Compact Modular System for Teleoperated Laparoendoscopic Single Site Surgery**
O. Isaac-Lowry*, S. Okamoto, P. Berkelman
Department of Mechanical Engineering, University of Hawaii-Mano, USA
- P33 **Open-Loop Tip Accuracy of an MRI-Compatible Active Cannula Robot**
D.B. Comber¹, E.J. Barth*¹, R.J. Webster III¹, J.S. Neimat²
¹*Department of Mechanical Engineering, Vanderbilt University, USA*
²*Department of Neurological Surgery, Vanderbilt University Medical Centre, USA*
- P34 **5-DOF Manipulation of a Magnetic Capsule in Fluid using a Single Permanent Magnet: Proof-of-Concept for Stomach Endoscopy**
A.W. Mahoney*¹, J.J. Abbott²
¹*School of Computing, University of Utah, USA*
²*Department of Mechanical Engineering, University of Utah, USA*
- P35 **Endoscopic Submucosal Dissection for Gastric Lesions using a Flexible Snake Robot – Early Assessment and Feasibility Study**
N.K. Patel*, T.P. Cundy, J. Shang, C.J. Payne, C.A. Seneci, V. Vitiello, J. Clark, J. Teare, A. Darzi, G.-Z. Yang
The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
- P36 **Patient Mounted CT and MRI Compatible Shoulder Arthrography Robot for Needle Guidance in Paediatric Interventional Procedures**
R. Monfaredi^{1,2}, R. Sze¹, N. Safdar¹, K. Sharma¹, K. Cleary*¹
¹*Sheikh Zayed Institute for Paediatric Surgical Innovation, Children's National Medical Centre, Washington, USA*
²*Azad University, Tehran, Iran*
- P37 **A Novel Three-Dimensional Stereoscopic Viewer for Transanal Endoscopic Microsurgery: A Report of Two Clinical Cases**
A. di Marco*, P. Pratt, G.-Z. Yang, A. Darzi
The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
- P38 **The Core-Snake, the Variable Stiffness Laparoscopic Camera**
A. Jiang^{1*}, K. Althoefer¹, P. Dasgupta², T. Nanayakkara¹
¹*Centre for Robotics Research, King's College London, UK*
²*MRC Centre for Transplantation, NIHR Biomedical Research Centre, King's College London, UK*

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12:30 Lunch and Poster Session

14:00 Panel Discussion and Debate

Chair: Guang-Zhong Yang

Session 5 - Intraoperative Tissue Tracking and Characterisation

Chairs: Gabor Fichtinger, Cameron Riviere

14:45 Brain Surface Tissue Deformation Tracking in Craniotomies

R. Vivanti¹, O. Sadowsky¹, M. Shoham², L. Joskowicz*¹,

¹*School of Engineering and Computer Science, The Hebrew University of Jerusalem, Israel*

²*Faculty of Mechanical Engineering Technion, Israel Institute of Technology, Haifa, Israel*

15:00 A Low Cost System for 3D Position and Orientation Sensing

K. O'Donoghue*, P. Cantillon-Murphy

School of Engineering, University College Cork, Ireland

15:15 An Ultrasound-Based Methodology for Endoluminal Robot Tracking in Cardiovascular Procedures

M. Mura, G. Ciuti, P. Dario, A. Menciassi*

The BioRobotics Institute, Scuola Superiore Sant'Anna, Italy

15:30 Salient Features of Soft Tissue Examination Velocity during Manual Palpation

J. Konstantinova*¹, K. Althoefer¹, P. Dasgupta², T. Nanayakkara¹

¹*Centre for Robotics Research, King's College London, UK*

²*MRC Centre for Transplantation, DTIMB and NIHR BRC, King's College London, UK*

15:45 Coffee Break and Posters

Session 6 - Perceptual Docking

Chairs: Simon DiMaio, Howie Choset

16:15 Karl Storz - Harold Hopkins Lecture: Ferdinand Köckerling, Vivantes Klinikum Spandau, Germany
Robotics in Bariatric Surgery

17:00 Robotic Steering of Cardiac Ultrasound Imaging Catheters

L.J. Brattain*^{1,2}, P.M. Loschak¹, C.M. Tschabrunn³, E. Anter³, R.D. Howe¹

¹*Harvard School of Engineering and Applied Sciences, Cambridge, MA, USA*

²*MIT Lincoln Laboratory, Lexington, MA, USA*

³*Harvard-Thorndike Electrophysiology Institute, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, USA*



- 17:15 Collaborative Robot-Assisted Endovascular Catheter Navigation using Learned Models**
H. Rafii-Tari*, J. Liu, S.-L. Lee, G.-Z. Yang
The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
- 17:30 Workspace Analysis and Calibration Method for Mobile Image Overlay System used for Image-Guided Interventions**
M. Anand*¹, T. Ungi¹, T.A. Lasso¹, P.U. Thainual¹, J. Jayender², J. Fritz³, J.A. Carrino³, F. Jolesz², G. Fichtinger^{1,3}
¹*Laboratory for Percutaneous Surgery, Queen's University, Canada*
²*Surgical Planning Laboratory, Harvard Brigham and Women's Hospital, USA*
³*Department of Radiology and Radiological Science, Johns Hopkins University, USA*
- 17:45 Smooth Active Constraints Employed for Position and Force Control in Robot Assisted Surgery**
A. Proesch, S. Bowyer, F. Rodriguez y Baena*
Department of Mechanical Engineering, Imperial College London, UK
- 18:00 Closing Remarks & Awards followed by Drinks Reception**

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