

Ravi Vaidyanathan

Senior Lecturer in Bio-Mechatronics
Department of Mechanical Engineering
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Career Synopsis

- Biomechatronics academic; research focus in hierarchical mechanisms of sensory-motor control with application mobile robots and cybernetics
- Director: [Biomechatronics Laboratory](#), Imperial College London (12 full-time researchers)
- Awarded 20+ research grants in the US, UK, and Singapore; £7 million+ in support
- Authored 35+ journal publications; 2100+ citations, H-index 20 (Google Scholar)
- Inventor on 5 pending patents; 4 spin-out companies founded from academic research; former holder of 2 industrial directorships
- Recipient of international accolades for research innovation from organizations including: IEEE Robotics and Automation Society, UK IET, UK NHS, SAGE Publishers, Robotics Society of Japan (RSJ), and American Institute of Aeronautics and Astronautics (AIAA)
- Research featured for impact in public press on 30+ occasions by groups including: New Scientist, the Discovery Channel, ITV News, Gadget Show, IEEE Spectrum, and the BBC

Education

Ph.D., Mechanical Engineering (Bio-inspired Systems), Case Western Reserve University (Case), Cleveland, Ohio, USA, 2001

Dissertation: “An Insect-Inspired Orientation Reflex for Autonomous Vehicles”

M.S Mechanical Engineering (Robotics and Control), Case Western Reserve University (Case), Cleveland, Ohio, USA, 1996

M.S. Thesis: “Design and Construction of a Biologically Inspired Hydrostatic Robot”

Professional Experience

Full-Time Academic Appointments

- Senior Lecturer in Biomechatronics, Department of Mechanical Engineering, Imperial College London, London, UK 5/11-present
- Senior Lecturer in Biologically Inspired Systems, Department of Mechanical Engineering, University of Bristol, Bristol, UK 1/08-5/11
- Senior Fellow in Neural Engineering, School of Rehabilitation Sciences & Institute of Sound and Vibration Research, University of Southampton, Southampton, UK 10/06-12/07

Selected Industrial Appointments

- Research Director (co-founder), AthleTec, Inc., Manchester, UK 10/15-present
- Chief Executive Officer (co-founder), BioRobots, Ltd., Cleveland, USA 7/03-present

Selected Honours and Awards

Featured Speaker: New Scientist Live Forthcoming: Sept 2017

Featured speaker at science showcase, *New Scientist Live Festival* (30,000 attendees) for cybernetics

Winner: UK Institute of Engineering Technology (IET) Award Awarded: June 2016

“Most Promising Innovation in Robotics” (Robot Therapy for Parkinson’s Disease)

Finalist: UK Big Chip Digital Industry Award Awarded June 2016

“Most Innovative Application of Technology” (Corner Smart Boxing Wearable System)

Winner: Gadget of the Month, Wearable Technologies Magazine Awarded March 2016

Wearables in combat sports

Winner: UK National Health Service (NHS) Innovation Challenge Awarded: Jan 2016

“Innovations for self-rehabilitation and monitoring of arm disability” (Team led by P. Bentley, MD)

Finalist: Best Student Paper (Supervisor) Awarded May 2015

IEEE International Conference on Computer Based Medical Systems (CBMS), New York, USA

“Pervasive motion tracking and muscle activity monitor”

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SAGE Best Paper Award

Awarded: May 2013

“Best Paper” (2012), *Journal of System and Control Engineering*, SAGE Publishers

First author: “Reflexive Control Based on a Neural Model of the Cockroach Escape Response”

Winner: Frazer-Nash Consultancy Prize

Awarded: May 2011,12

Two-time winner of innovation in engineering systems award from UK industrial consultancy for system optimization research

Winner: N-Power Energy Challenge (Faculty Advisor)

Awarded: June 2010

Faculty advisor to team winning first prize out of several hundred entrants in the UK and Germany; solution presented at UK Parliament June 2010

Finalist: Best Paper in Conference

Awarded: Nov 2008

IEEE International Conference on Intelligent Automation & Robotics, San Francisco, USA

Co-author: “Design and Testing of an Autonomous Robot in a Beach Environment”; one of three award finalists out of 400+ paper submissions

New Technology Foundation Award on Robots and Systems

Awarded: Oct 2007

“Human Medical Assist based on Aural Flow”; sponsored by the New Technology Foundation (NTF) Japan, awarded at the 20th IEEE International Conference on Intelligent Robots and Systems (IROS); 10 research works recognized from 12,000+ from 1987-2007

Best Paper in Conference

Awarded: Aug 2005

IEEE International Conference on Intelligent Robots and Systems (IROS), Sendai, Japan

First author: “Human-Machine Interface for Tele-Robotic Operation Based on Aural Flow”

Patents

1. R. Vaidyanathan, F. Cegla, J. Jeffers, *Zero Power In Vivo Orthopaedic Sensing System*, to be submitted Summer 2017
2. T. Burton, A. McGregor, R. Vaidyanathan, *Sensor Array*, UK action 1500949.1, final disposition pending
3. R Vaidyanathan, R. Woodward, N. Nowlan, S. Shefelbine, *Biomechanical Activity Monitoring*, UK action 1319434.5, final disposition pending
4. Boria, F., Bachman, R., Vaidyanathan, R. Quinn, R.D., Ifju, P., *Vehicle Configured for Aerial and Terrestrial Locomotion*, U.S.A. patent service action 11/782,585, final disposition pending
5. R. Vaidyanathan, *Autonomous Reflex System and Method for Vehicles*, U.S.A. patent service action 10/259,203, final disposition pending

Selected Research Grants (taken from 20+ in total)

1. Principal Investigator,
2. Co-investigator, *Mechanical Muscle Activity with Real-time Kinematics (M-MARK): A novel combination and application of existing technology designed to improve arm recovery following stroke*, Nov 2015-Nov 2017, UK National Institute of Health Research (NIHR) grant II-LB-0814-20006, £1,080,000
3. Principal Investigator, *A Tele-Operative Sensory Motor Control Interface*, Oct 2014-Oct 2017, US Office of Naval Research Global (ONR-G) grant N62909-14-1-N221-P00002, \$375,000
4. Principal Investigator, *Low-Power Pervasive Physiological Interfaces*, Dyson Foundation, Oct 2012-Oct 2017, £150,000
5. Research Board Member, *Centre for Doctoral Training (CDT) in Neurotechnology*, UK Engineering and Physical Sciences Research Council (EPSRC), Oct 2013-Oct 2018, £10 million
6. Principal Investigator, *Robotic Instruments for Adaptive Neurostimulation and Interface with the Basal Ganglia*, Engineering and Physical Sciences Research Council (EPSRC) Centre for Doctoral Training (CDT) in Neurotechnology, £330,000, Oct 2016-Oct 2021
7. Principal Investigator, *A Tongue Movement Command and Control System Based on Aural Flow Monitoring*, May 2008 - Nov 2012, UK Engineering and Physical Sciences Research Council (EPSRC), grant EP/F01869X, £364,450

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Selected Refereed Journal Publications (taken from 35+ in total)

1. R Woodward, S Shefelbine, R Vaidyanathan, "Gait Analysis Using Pervasive Motion Tracking and Mechanomyography Fusion" accepted, *IEEE Transactions on Mechatronics*, 12pp, 2017
2. J Burridge, A Lee, R Turk, M Stokes, J Whittall, R Vaidyanathan, "Tele-health, wearable sensors and the Internet: Will they improve stroke outcomes through increased intensity of therapy, motivation and adherence to rehabilitation programs?" *Journal of Neurologic Physical Therapy*, 1-25, 2017
3. K Mamun, M Mace, M Lutman, J Stein, X Liu, T Aziz, R Vaidyanathan, S Wang, "Movement decoding using neural synchronisation and inter-hemispheric connectivity from deep brain local field potentials", *Journal of Neural Engineering*, 12, 5, pp 1-18, 2015
4. R. Lock, R. Vaidyanathan, S.C. Burgess, "Multi-modal locomotion: from animal to application", *Bioinspiration and Biomimetics*, 9, pp 1-18, 2014
5. M. Mace, N. Yousif, M. Naushahi, K. A. Mamun, S. Wang, D. Nandi, R. Vaidyanathan, "An automated approach towards detecting complex behaviours in deep brain oscillations", *Journal of Neuroscience Methods*, 224, pp 66-78, 2014
6. M Mace, K Abdullah-al-Mamun, A.A. Naeem, L Gupta, S. Wang, R. Vaidyanathan "A heterogeneous framework for real-time decoding of bioacoustic signals: Applications to assistive interfaces and prosthesis control", *Expert Systems with Applications*, 40, 13, pp 5049-5060, 2014
7. S. O.H. Madgwick, A.J.L. Harrison, P. M. Sharkey, R. Vaidyanathan, W. S. Harwin, "Measuring motion with kinematically redundant accelerometer arrays: Theory, simulation and implementation", *Mechatronics*, 23,5, pp 518-529, 2013
8. Kota S., Gupta L., Molfese D., Vaidyanathan R., "Diversity-Based Selection of Polychotomous Components for Multi-Sensor Fusion Classifiers", *Journal of Engineering in Medicine*, 227, 6, 655-662, 2013
9. K. A. Mamun, M. Mace, L. Gupta, C. A. Verschuur, M. E. Lutman, M. Stokes, R. Vaidyanathan, S. Wang, "Robust Real-time Identification of Tongue Movement Commands from Interferences," *Neurocomputing*, 80, pp 83-92, 2012
10. Araromi OA, Conn A.T., Ling CS, Burgess SC, Rossiter JM, Vaidyanathan R., "Spray Deposited Multilayered Dielectric Elastomer Actuator", *Sensors and Actuators A*, 167, pp 459-467, 2011
11. Gupta L., Kota S., Murali S., Molfese D., Vaidyanathan R., "A Feature Ranking Strategy to Facilitate Multivariate Signal Classification", *IEEE Transactions on Systems, Man, and Cybernetics C (SMC-C)*, 40, 1, pp 98-108, 2010

Selected Major Keynote, Invited and/or Plenary Lectures

1. *Biomechatronics: from Insects to In-Vivo Mechatronics*, Keynote Speaker, IEEE International Conference on Medical Engineering, Health Informatics and Technology (MediTec2016), Dhaka, Bangladesh, Dec 2016
2. *Neuromechanics and Hierarchical Systems: Complexity, Coupling and Cockroaches*, Keynote Speaker, IEEE Swarm Human Blended Intelligence Conference (SHBI), Cleveland, OH, USA, Oct 2016
3. *Bio-Inspired Systems Architectures in Translational Human-Machine Interface*, Invited Speaker, Commercial UAV Conference, London, UK, Oct 2016
4. *Translation of Neuromechanics Research in Mobile and Medical Platforms*, Invited Speaker, Johns Hopkins Applied Physics Laboratory (APL) Center for Intelligent Systems, Aug 2016
5. *Bionic Augmentation and Wearable Tech*, Keynote Speaker, Fit-Tech Summit, London UK, March, 2016
6. *Neuromechanics and Adaptive Mechanisms Enabling Multi-modal Locomotion: Current Status and Future Promise*, Keynote: Multi-Modal Locomotion Workshop, IEEE International Conference on Biorobotics and BioMechatronics, Rome, IT, June 2012
7. *Biorobotics: Current Status, Bottlenecks, and Future Design*: Introductory talk to Plenary Session Biorobotics, IEEE International Conference on Intelligent Robots and Systems (IROS), San Francisco, CA, USA, Sept 2011

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Academic (Research) Leadership Positions

- **Co-Chair:** *IEEE Robotics and Automation Society Technical Committee on Biorobotics*, IEEE Robotics and Automation Society
Nominated as one of four (European representative) co-chairs for the *IEEE Robotics and Automation Society Technical Committee on Biorobotics*; coordinated academic activities and set future directions for IEEE Robotics Society in biorobotics 2009-present
- **Chair:** *Bristol Robotics Laboratory Steering Committee*, University of Bristol and University of West England
Nominated to lead advisory committee (of 12 appointed members) directing future activities and current direction of Bristol Robotics Laboratory (BRL) 2008-present
- **Director:** *Biologically Inspired Systems Laboratory*, US Naval Postgraduate School
Led research efforts at NPS Bioinspired Systems laboratory 2004-2006

Academic Administrative Positions

- **Deputy Admissions Tutor:** *Department of Mechanical Engineering*, Imperial College London
Supported undergraduate (overseas and home) admissions; set admissions policy and entry criteria; 2011-2012
- **Programme Director,** *MSc in Advanced Engineering Robotics*, University of Bristol
Founded new MSc programme at University of Bristol in *Advanced Engineering and Robotics* highlighting robotics, bioengineering, and machine learning; coordinated specific unit delivery in biologically inspired systems and medical robotics 2010-2011
- **Admissions Officer:** *Department of Mechanical Engineering*, University of Bristol
Directed undergraduate (overseas and home) admissions; set admissions policy and entry criteria; reviewed over 1,500+ applications for 70 positions; coordinated student visits, information sessions, open days, and other recruitment/marketing activities 2009-2010

Courses Designed and Taught

1. *System Design and Optimization*, course taught in Department of Mechanical Engineering, Imperial College London, UK, 2013-present
2. *Embedded C for Microcontrollers*, course taught in Department of Mechanical Engineering, Imperial College London, UK, 2011-present
3. *Advanced Robotic Systems*, course taught in Departments of Mechanical Engineering and Computer Science, University of Bristol, Bristol, UK, 2010-11
4. *Biologically Inspired Systems*, course taught in Department of Mechanical Engineering, University of Bristol, Bristol, UK, 2009-10
5. *Introduction to Signal Processing* (laboratory section), organized and taught two new laboratories (“Data Acquisition” and “Introduction to Spectral Analysis”), Institute of Sound and Vibration Research (ISVR), University of Southampton, Southampton, UK, 2006-07
6. *Emergent Behaviour and Decentralized Systems*, section of course *Analytic Tools for the Warfare Commander*, US Navy War College, Newport, RI, USA, 2007-08
7. *Adaptive Control*, course taught in Department of Electrical Engineering, Naval Postgraduate School, Monterey, CA, USA, 2006
8. *Fundamentals of Systems Engineering*, course taught in Department of Systems Engineering, Naval Postgraduate School, Monterey, CA, USA, 2006, 2009
9. *Engineering Project Management*, course taught in Department of Systems Engineering, Naval Postgraduate School, Monterey, CA, USA, 2005
10. *Biologically Inspired Robotics*, course taught in Department of Mechanical and Aerospace Engineering, Case Western Reserve University, Cleveland, OH, USA, 2003
11. *Design of Mechanical Elements*, (teaching assistant), course taught in Department of Mechanical and Aerospace Engineering, Case Western Reserve University, Cleveland, OH, USA, 1995-97 (nominated “Teaching Assistant of the Year”, 1997)