Soft Robotics and electroactive polymers

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Google “Robot”, 12 November 2014

Google “Soft Robot”, 24 November 2014

Whitesides Group, Harvard (www.youtube.com/watch?v=2DsbS9cMOAE)

Walters UWE/BRL (www.youtube.com/watch?v=v6u26nol5H4)

Bristol Robotics Laboratory
largest robotics research centre in the UK

“from soft materials and compliant mechanisms to soft-smart machines and beyond”

Soft-smart Materials
Soft-smart Mechanisms
Soft-smart Machines

The Soft Robotics Group
• Jonathan Rossiter
• Andrew Conn
• researchers:
  Tareq Assaf, Jon Winfield, Helmut Hauser
• PhD students:
  E.Knoop, A. Hinitt, A. Bowers, H. Philamore,
  M. Dicker, A. Bell, A. Fishman, P. Zanini
• Peter Walters (3D fabric, UWE)
• Ioannis Ieropoulos (energy and ecology, UWE)

Smart materials I

• Electroactive Ionic Electronic
  • Thermoeactive
  • Chemoactive
  • Photoactive
  • Shape memory

Ionic actuation
Voltage OFF Uniform cation distribution
Voltage ON Cation migration
Smart materials II

Electronic actuation – Dielectric elastomers

Spray deposition of DEAs

3D Printing soft machines

Novel actuation modes

“Musculoskeletal” type 6-DOF conical DE design

Soft robotics and camouflage

Artificial chromatophores and smart skins

Cephalopod-inspired chromatophores

Zebradfish-inspired fluid translocation

Tactile stimulation

Whiskers and skins

Electronic actuation – Dielectric elastomers

Spray deposition of DEAs

3D Printing soft machines

Conn and Rossiter (2012) “Towards holonomic electro-elastomer actuators with six degrees of freedom,” Smart Materials and Structures, 21

Walters, Rossiter & Stoimenov (2009) EAPAD 2009

Araromi, Conn, Ling, Rossiter, Vaidyanathan, Burgess (2011) Sensors and Actuators A Physical, 171

Walters, Rossiter & Stoimenov (2009) EAPAD 2009

Soft robotics and camouflage

Artificial chromatophores and smart skins

Soft robotics and camouflage

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Tactile stimulation

Whiskers and skins

Roger Hanlon, MBL

www.youtube.com/watch?v=GRVwGHi54Mw

Beutigard Brats

www.youtube.com/watch?v=G-D-0MvHb5s

Cephalopod-inspired chromatophores

Zebrafish-inspired fluid translocation

Assaf et al. SPIE EAPAD 2014

Whiskers and skins

Prescott, Sheffield

www.youtube.com/watch?v=TV1E3dDq83w

Assaf et al. SPIE EAPAD 2014

Assaf et al. IEEE Sensors 2013

Rossiter, Yap and Conn (2012) “Biomimetic chromatophores for camouflage and soft active surfaces,” Bioinspiration and Biomimetics, 7
Kirgami and laminar soft robots
Self-opening soft cuspid valves
Artificial Cilia

Auxetic and self-deploying structures
Auxetic shape memory polymers
Radially Folding Structures

Biodegradable Robots

Soft Robotics: questions and challenges
• Soft-Smart Materials
  • Functional materials
  • Stronger; faster; scalable
  • Biocompatible and biodegradable
  • Bio-hybrid
• Self organisation
  • Ultra-thin layers
  • 3D Structures
• Soft-Smart Mechanisms
  • Compliant mechanisms
  • Morphological computation
  • Embedded intelligence
  • Communication and control
• Soft-Smart Machines
  • Micro/nano soft robots
  • Biodegradable
  • Cooperative/synergist behaviour
  • Implantable medical devices
  • Assist devices
  • Environmental remediation

www.robosoftca.eu
RoboSoft: Building a scientific community in Soft Robotics