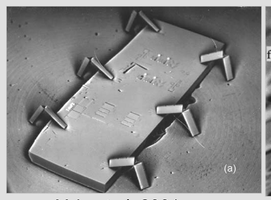
Micro Robotics Lab

Prof. Sarah Bergbreiter

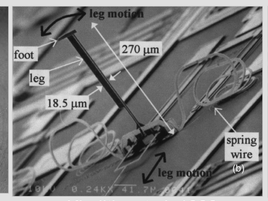
30 THIRTY YEARS OF SYSTEMS RESEARCH EXCELLENCE

INSTITUTE FOR SYSTEMS RESEARCH
A. JAMES CLARK SCHOOL OF ENGINEERING

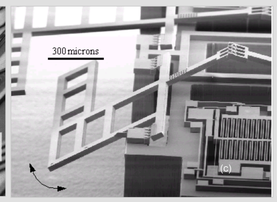
Past: Microfabrication + Robotics = very slow, tethered robots (~1 cm in size) that can only 'walk' on silicon wafers



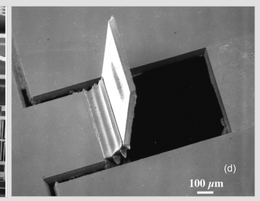
Yeh, et al. 2001



Kladitis, et al. 1999



Hollar, Flynn, Bergbreiter, Pister 2003



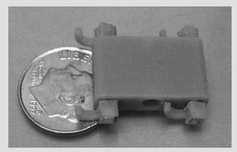
Ebefors, et al. 1999

Q: How can we better integrate robotic systems at small scales and improve performance in larger robotic systems with microfabrication?

Future: Microfabrication + Robotics = Better robots at all scales!

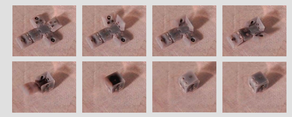
Understanding locomotion at small scales

Q: How should robots locomote at small scales? How can we use these robots as physical models for biomechanics?



Integration of multi-functional systems in 3D for improved actuation and sensing

Q: How can microfabricated sensors and actuators be better integrated in 3D for more DOF in larger systems?

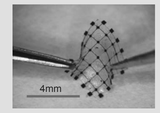


Model-based systems engineering for small-scale robots

Q: How to best design with multiple material and geometry options?
Q: How should control be distributed through mechanical and electrical sub-systems?

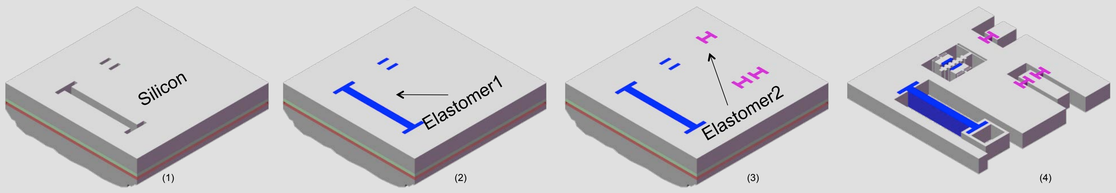
Incorporating Microfabrication with Medical Robotics

Q: How can microfabricated sensors and actuators be implanted or integrated in traditional medical systems like catheters?

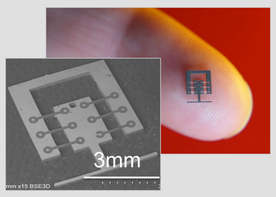


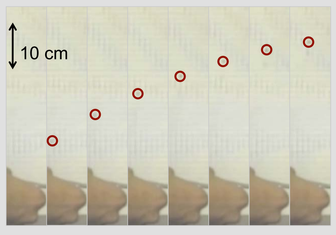
Present: Expanding the materials toolbox in microfabrication for improved locomotion and efficiency in small robots

Adding soft materials to silicon microfabrication

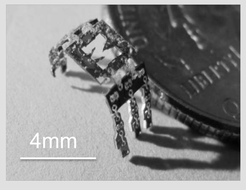


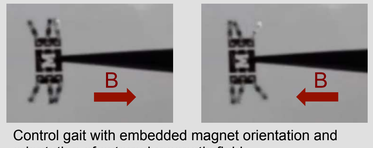
Elastomer energy storage for jumping robots





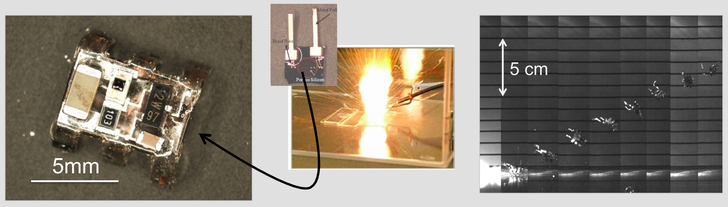
Elastomer joints with magnetic actuation for walking/running robots



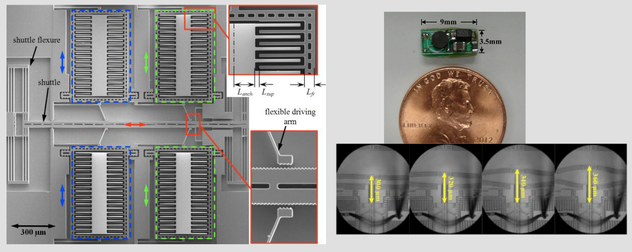


Control gait with embedded magnet orientation and orientation of external magnetic field

Energetic actuation for jumping robots (w/ ARL)

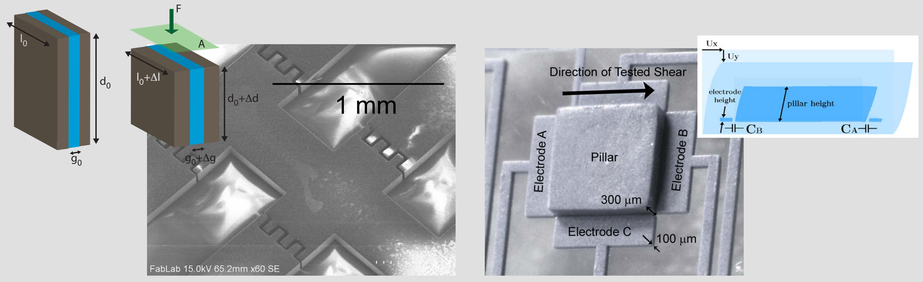


High force density, efficient microactuation systems (w/ Alireza Khaligh)

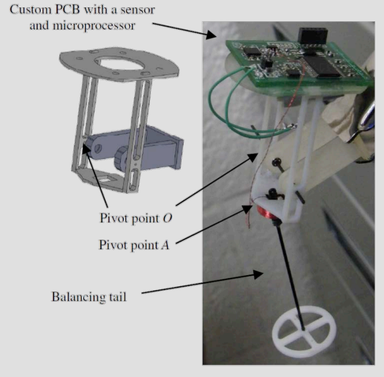


Present: Microfabrication with multiple materials for improved sensors and actuators in larger robots

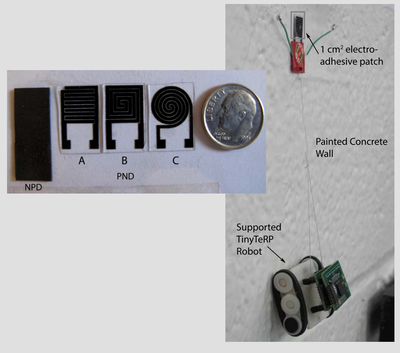
Elastomer-based capacitive force/strain sensing systems for tactile sensing



Inertial appendages (tails) for stability and maneuverability on larger robots



Electroadhesives to control robot adhesion to surfaces for climbing



Funding thanks to:

Thanks to many students and collaborators including (but not limited to!) Aaron Gerratt, Ivan Penskiy, Dana Vogtmann, Wayne Churaman, Alexi Charalambides, Simpson Chen, Ryan St. Pierre, Xiaotian Ma

http://mrl.umd.edu