Distributed Intelligence in Microrobots

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Abstract

Microrobots are endowed with on-board sensing, computation, communication, actuation, and energy management. Potential applications include biomedical applications such as theranostics and microsurgery. The types of algorithms appropriate for these microrobotic systems, where on-board capabilities are necessarily minimal, differ from those typical for macroscale systems. Given these limitations, the main advantage microrobots have is that they can be massively distributed, indicating a need for scalable learning and control strategies that emphasize distributed capability over individual robot capability. This talk will focus on some tasks that microrobots can potentially accomplish, even given their severe limitations, and algorithms that naturally distribute across microrobotic systems. Moreover, some environments are particularly supportive of microrobot learning, so that when microrobots have local communication one can generate tight bounds on their optimal distributed performance. These results indicate the power of collective intelligence, even for very limited individual microrobots, and provide a setting for specifying requirements on microrobot design.

Short Biography

Todd Murphey is a Professor of Mechanical Engineering in the McCormick School of Engineering and of Physical Therapy and Human Movement Sciences in the Feinberg School of Medicine, both at Northwestern University. He received his Ph.D. in Control and Dynamical Systems from the California Institute of Technology. His laboratory is part of the Center for Robotics and Biosystems, and his research interests include robotics, control, human-machine interaction, and emergent behavior in dynamical systems. He received the National Science Foundation CAREER award, was a member of the 2014-2015 DARPA/IDA Defense Science Study Group, and is a member of the United States Department of the Air Force Scientific Advisory Board.