Motion Control of Cellular Robots

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Abstract

Biological cellular robots can be produced under low cost in large numbers, making them an attractive option for microscale actuation. In this talk, I will present the results and challenges in establishing motion control for such robots. I will focus on magnetically-steered ciliate eukaryon (Tetrahymena pyriformis) as a case study. In the first part of the talk, I will focus on results on motion control of individual cells. In the second part of the talk, I will focus on results and challenges in simultaneous motion control if multiple cells. This is an particularly challenging problem because these cellular robots are typically controlled using a uniform input signal, which makes them a severely under-actuated system.

Biography

A. Agung Julius is an Associate Professor in the Department of Electrical, Computer, and Systems Engineering at Rensselaer Polytechnic Institute. He earned the Ph.D. degree in applied mathematics from the University of Twente, The Netherlands in 2005. In 2005 – 2008, he was a Postdoctoral Researcher at the University of Pennsylvania.

Dr. Julius' research interests include systems and control, systems biology, stochastic models in systems biology, control of biological systems, hybrid systems, and mathematical systems theory. He is a co-author of the Best Application Paper in the 10th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI 2013), and a finalist for the Best Paper Award at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2013). At Rensselaer, he received the School of Engineering Award for Research Excellence (2016) and the James M. Tien'66 Early Career Award for Faculty (2017). He also received an NSF CAREER award in 2010.