Local Magnetic Field Design, Characterization, and Path Planning for Independent Control of Multiple Mobile Microrobots for Micro-Factory Applications

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Abstract:
In this talk, I will present a new localized magnetic field generating system consisting of microcoils in two different layers of a printed circuit board that can be used for the independent control of multiple magnetic microrobots for micro-factory applications. Such a system will allow for cooperative or parallel microassembly tasks with teams of magnetic microrobots. We have modeled and characterized the performance of the microcoils in the workspace by analyzing the effects of input current and substrate layer position. The interactions between the magnetic microrobots that affect their motion in the workspace were also studied. The local magnetic field generates sufficient forces in the workspace to enable the control of multiple microrobots in the workspace. We have also integrated an A* based graph search algorithm with our automated computation of local magnetic fields to ensure the successful navigation of a robot in a realistic workspace with multiple obstacles. Finally, we present experimental results that showcase the capabilities of the localized magnetic field generating system

Biography
David J. Cappelleri is an Associate Professor in the School of Mechanical Engineering at Purdue University in West Lafayette, IN. Prof. Cappelleri founded the Multi-Scale Robotics & Automation Lab that performs cutting-edge research on robotic and automation systems at various length scales. He has received various awards, such as the National Science Foundation CAREER Award, Harvey N. Davis Distinguished Assistant Professor Teaching Award, and the Association for Lab Automation (ALA) Young Scientist Award. Prof. Cappelleri is an elected member of the IEEE Robotics and Automation Society (RAS) Technical Committee on Micro/Nano Robotics and Automation, the IEEE RAS Technical Committee on Mechanisms and Design, and the ASME Design Engineering Division Mechanisms & Robotics Committee. He received the B.S. and M.S. degrees in Mechanical Engineering from Villanova University, and The Pennsylvania State University, and a Ph.D. from the University of Pennsylvania in Mechanical Engineering and Applied Mechanics.