Self-reconfiguring Robots: Successes and Challenges

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Abstract

We wish to create versatile robots by using self-reconfiguration: hundreds of small modules autonomously organize and reorganize as geometric structures to best fit the terrain on which the robot has to move, the shape of the obiect the robot has to manipulate, or the sensing needs for the given task. Self-reconfiguration allows large collections of small robots to actively organize as the most optimal geometric structure to perform useful coordinated work.

A self-reconfiguring robot consists of a set of identical modules that can dynamically and autonomously reconfigure in a variety of shapes, to best fit the terrain, environment, and task. Self-reconfiguration leads to versatile robots that can support multiple modalities of locomotion and manipulation. Self-reconfiguring robots constitute large scale distributed systems. Because the modules change their location continuously they also constitute ad-hoc networks.

This talk will discuss the challenges and successes of creating self-reconfiguring robots, ranging from designing hardware capable of self-reconfiguration to developing distributed controllers and planners for such systems that are scalable, adaptive, and support real-time behavior.

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