1135-60-2786 **Andrea W. Richa*** (aricha@asu.edu), Computer Science and Engineering, CIDSE, Arizona State University, PO Box 878809, Tempe, AZ 85287-8809, and **Sarah Cannon**, **Joshua J. Daymude**, **Dana Randall** and **Marta Andres Arroyo**. *Local Stochastic Algorithms for Compression and Shortcut Bridging in Programmable Matter.*

Many programmable matter systems have been developed, including modular and swarm robotics, synthetic biology, DNA tiling, and smart materials. We describe programmable matter as an abstract collection of simple computational elements (particles) with limited memory that each execute fully distributed, local, asynchronous algorithms to solve system-wide problems such as movement, configuration, and coordination. For the compression problem, in which a particle system is tasked with gathering as tightly as possible, we give a Markov chain based solution that minimizes the overall perimeter of the system via individual particles making decisions based only on information about their local neighborhoods. Variants of this algorithm produce a variety of other useful behaviors, including expansion over as wide an area as possible. Subsequently we present a distributed stochastic algorithm for particle systems forming shortcut bridges, a behavior also observed in army ants, where balancing between two competing global objectives is observed. For all of these problems, tools from Markov chain analysis and distributed algorithms allow us to relate local and globally optimal behavior, and to produce local algorithms that are robust, nearly-oblivious, and truly decentralized. (Received September 26, 2017)