

DNA-Based Self-Assembly and Nanorobotics

Sudheer Sahu, John H. Reif



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We study the following fundamental questions in DNA- based self-assembly and nanorobotics: How to control errors in self-assembly? How to construct complex nanoscale objects in simpler ways? How to transport nanoscale objects in programmable manner? In our quest to answer these questions, we present a comprehensive theory of compact error-resilient schemes for algorithmic self-assembly in two and three dimensions, and discuss the limitations and capabilities of redundancy based compact error correction schemes. We present a time-dependent glue model for reversible self-assembly model. We can assemble thin rectangles of size $k \times N$ using O (logN/loglogN) types of tiles in our model. We present a framework for a discrete event simulator for DNA-based nanorobotical systems. We design a class of DNAzyme based nanodevices that are autonomous, programmable, and require no protein enzymes. In addition to these, we also attempt to harness the mechanical energy of a polymerase ϕ 29 to construct a polymerase based nanomotor that pushes a cargo on a DNA track.

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