

Negative interactions in irreversible self-assembly

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Abstract:

Tile-based self-assembly is a model of algorithmic structural growth in which square tiles can represent molecules that bind to each other via bonds on their four sides. Two tiles that are placed next to each other are attracted with strength determined by the glues on the connected sides. A tile binds to an assembly if it is attracted on all matching sides by the total strength of at least a certain threshold value τ . This threshold models the temperature at which insufficiently strong chemical bonds will break. Tile assembly can be reversible or irreversible. In the irreversible model, for a tile/assembly to attach to an assembly, it must bind with strength $\geq \tau$. In the reversible model, a tile/assembly may attach with strength $< \tau$, implying that it may detach, but may also cause another tile to detach. In this presentation, a variant of irreversible tile assembly model is studied in which glue strengths are allowed to be negative as well as positive. Using this model, we are able to simulate an t -time-bounded s -space-bounded Turing machine.

Doty, D., Kari, L., & Masson, B. (2013). Negative interactions in irreversible self-assembly. *Algorithmica* 66(1), 153-172)