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Algorithmic DNA Self-Assembly

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Abstract:

Self-assembly is a process by which simple objects autonomously assemble into complexes. This phenomenon is common in nature but is not yet well understood from mathematical and programming perspectives. It is believed that self-assembly technology will ultimately permit the precise fabrication of complex nanostructures. There are many kinds of self-assembly and DNA self-assembly is of particular interest.

Algorithmic DNA self-assembly is both a form of nanotechnology and a model of DNA computing. As a computational model, algorithmic DNA self-assembly first encodes the input of a computational problem into DNA patterns and shapes; and then manipulates these structures to produce new DNA structures that encode the desired output of the computational problem. As a nanotechnology, the goal of algorithmic DNA self-assembly is to design tiles with carefully chosen glue types on their four sides. Tiles are said to be of different types if their sides have different glue types. Useful tile types are non-trivial to design but relatively easy to duplicate in large quantity. A key design challenge for algorithmic DNA self-assembly is to use only a small number of different tile types to assemble a target nanostructure.

Speaker:

Prof Ming-Yang Kao, Professor of Computer Science, Northwestern University, is the Head of the Division of Computing, Algorithms, and Applications in the Department of Electrical Engineering and Computer Science. He has published extensively in the design, analysis, and applications of algorithms. His research interests include discrete optimization, bioinformatics, computational finance, computational economics, and DNA self-assembly. He is the editor-in-chief of Algorithmica and the Encyclopedia of Algorithms.