

Combinatorics of Surface Deformations

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Abstract

Configuration spaces are not only fundamental objects in mathematics, but appear in numerous areas such as robot motion planning, DNA sequencing, sensor networks, and origami designs. Our story is motivated by objects in algebraic geometry, namely the configuration space of surface deformations. To understand this space, we consider a combinatorial viewpoint based on scribbling loops on the surface. This leads to a classification of such spaces that can be realized as convex polytopes, capturing elegant hidden algebraic structures. These spaces now appear across a broad spectrum of research, including amplituhedra, geometric group theory, and phylogenetics networks. The entire talk is heavily infused with visual imagery and concrete examples.