A Hidden Structure of Spanning Trees

Abstract

Let S be the set of spanning trees of a given graph that is embedded in a plane. Mathematicians have long been interested in calculating the cardinality of S (a statistic that is sometimes called the complexity of the graph). However, there is more to explore about S than just its cardinality! This talk will focus on a concrete construction based on the rotor-routing algorithm. This construction gives S a group-like structure (which algebraists call a torsor, heap, or principal homogenous space). Remarkably, this structure is not only natural to describe, but also in some sense unique. My primary goal of the talk is to teach you how to divide one spanning tree by another, and then use this result to transform other spanning trees. My secondary goal is to share joint work with Ganguly, where we make precise and prove the uniqueness claim in the previous paragraph. If there is time, I will end the talk by discussing an ongoing project with Ding, Tóthmérész, and Yuen where we partially generalize the construction to arbitrary ribbon graphs and oriented regular matroids.

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