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Groves, Pfaffians, and crossing probabilities

A planar essential spanning forest is a spanning forest of a planar graph in which every component touches the outer boundary. The components of such a spanning forest define a partition of the boundary vertices. Given a random planar essential spanning forest of a finite planar graph with n boundary vertices, we show how to compute the probability of any particular partition as a rational function of the pairwise resistances.

Groves, defined by Carroll and Speyer, are certain kinds of essential spanning forests on planar graphs which arose in their study of the "cube recurrence relation". We show that a certain class of topologies of essential spanning forests, including groves, can be computed using Pfaffians. The proof is a generalization of the Karlin–McGregor–Lindstrom–Gessel–Viennot method.

This is joint work with David Wilson.