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Duality in Inductive Constructions of Circuits in 2-Rigidity via Tree Partitions

Given a graph $G = (V, E)$, a realization in the plane $G(\mathbf{p})$, as a framework, may be first-order rigid or first-order flexible. A basis is a minimal first-order rigid framework, while a circuit is a minimally redundant framework. For all generic realizations, the behaviour in the plane is determined by the combinatorics of the graph G. In this talk, we will investigate inductive constructions for extending a circuit to a larger circuit, for graphs on $|V|$ vertices which are rigid for generic realizations in the plane.

Using Crapo's characterization of circuits in terms of two spanning trees, we explore some global properties of the circuits in terms of local changes in the graphs around a few vertices. For circuits on planar graphs, these inductions have a striking duality. The plane dual of a 2-circuit is a 2-circuit. This duality pairs techniques in a direct fashion and offers additional insights and corollaries.

This talk is based on joint work with Walter Whiteley and Laura Chávez Lomelí.