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Trees, skeleta, and combinatorics of monomial chip-firing ideals

For any graph G , one can construct the ' G -parking function ideal' M_G , a monomial ideal whose standard monomials are in bijection with the spanning trees of G (and hence connect to various other combinatorial objects). Postnikov and Shapiro studied the ideals M_G in connection with power ideals and other deformations of 'monotone monomial ideals', and constructed minimal resolutions for certain classes. Minimal cellular resolutions of M_G for arbitrary G were later described by Dochtermann and Sanyal.

The ideals M_G are also strongly related to 'chip-firing' on the graph G , a dynamical system on the vertices governed by the Laplacian matrix. Motivated by these notions we study certain 'skeleta' of the ideals M_G , generated by certain subsets of the vertices of G . For some large classes we construct minimal resolutions and describe monomial bases. These constructions involve a number of combinatorial gadgets including tropical hyperplanes, the 'signless' Laplacian, and (new?) enumerations of Cayley trees.