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Title: The Critical group of a simplicial complex

Abstract: The critical group of a graph may be described as a quotient group in terms of the "chip-firing" game, as follows. It is the abelian group of all configurations of integer numbers of chips on the vertices of a graph, where two configurations are equivalent if you can get from one configuration to another by "firing" a vertex. By firing a vertex, we mean to send one chip from that vertex to each of its neighbors. The critical group of a graph may be computed from its reduced Laplacian matrix, and its order is the number of spanning trees of the graph.

We generalize this entire setup to higher-dimensional simplicial complexes. As in the graphical case, the critical group of a simplicial complex (if its codimension 1 skeleton has a suitably nice spanning tree) can be computed directly from the reduced Laplacian, and its order is given by a weighted count of the spanning trees. We also generalize the chip-firing game, using suitably-defined flows on higher-dimensional faces.

This is joint work with Carly Klivans and Jeremy Martin.