The Chip-firing Game and the Tutte Polynomial

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The chip firing game since its appearance has been proved to be fruitful for different fields such as graph theory, algebraic combinatorics, self–organized criticality and statistical physics.

Most of the research on chip firing games on undirected and directed graphs started as a way of analysing dynamic behaviour of processes in other areas, like Markov chains and self-critical systems. Later, Norman Biggs put a particular instance of chip firing games in the context of algebraic graph theory and showed its intrinsic relation with algebraic and combinatorial invariants of graphs, such as the Picard group or the number of spanning trees of the graph. Here we show that this chip firing game on graphs is actually related with the algebraic and topological structure of graphic matroids; specifically, with the Tutte polynomial of the graph and the h–vector of the matroid complex of the graph.