

Graphs in surfaces, their one-face subgraphs, and the critical group

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Critical groups are groups associated with graphs. They are well-established in combinatorics; closely related to the graph Laplacian and arising in several contexts such as chip firing and parking functions. The critical group of a graph is finite and Abelian, and its order is the number of spanning trees in the graph, a fact equivalent to Kirchhoff's Matrix-Tree Theorem.

What happens if we want to define critical groups for graphs embedded in surfaces, rather than for graphs in the abstract?

In this talk I'll offer an answer to this question. I'll describe an analogue of the critical group for an embedded graph. We'll see how it relates to the classical critical groups, as well as to Chumtsov's partial-duals, Bouchet's delta-matroids, and a Matrix-quasi-Tree Theorem of Macris and Pule.

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