

# A CRITICAL GROUP FOR EMBEDDED GRAPHS: WORKING WITH DELTA-MATROIDS

IN COLLABORATION WITH CRIEL MERINO AND IAIN MOFFATT

STEVEN NOBLE

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

How should we define critical groups for graphs embedded in surfaces, rather than for graphs in the abstract? This is the second of two talks in which we answer this question. (The first talk was given by Iain Moffatt.)

In the first talk topological graph theory suggested a way to define a critical group for graphs embedded in orientable surfaces. But it is far from obvious that this definition works. In this talk we reframe our construction in terms of regular delta-matroids and use this more general setting to finally determine the definition of a critical group.

Both talks will stand alone, so don't worry if you miss either one!

BIRKBECK, UNIVERSITY OF LONDON  
*Email address:* `s.noble@bbk.ac.uk`