Meeting: 999, Nashville, Tennessee, SS 5A, Special Session on Topological Aspects of Group Theory

999-20-230 **Daniel S Farley*** (farley@math.uiuc.edu), 407 E. Fairlawn Dr., Urbana, IL 61801, and **Lucas Sabalka**. *Discrete Morse Theory and Graph Braid Groups.*

Configuration spaces of graphs arise naturally in problems about robotics and motion planning. Let G be any finite graph, and fix a natural number n. The *labelled configuration space* LC^nG is the n-fold Cartesian product of G, with the set $\Delta = \{(x_1, \ldots, x_n) \mid x_i = x_j \text{ for some } i \neq j\}$ removed. The *unlabelled configuration space* C^nG is the quotient of LC^nG by the natural action of the symmetric group. The fundamental group of C^nG is called the *the braid group of* G *on* n *strands*. We apply a version of Morse theory to the spaces C^nG for any G and any n. As a result, we can compute presentations for the braid groups of an arbitrary tree for any number of strands. For any n and G, we also show that C^nG strong deformation retracts on a subcomplex of dimension at most k, where k is the number of vertices of G of degree at least 3. (This last theorem was first proved by Ghrist, but from a different point of view.) Our methods provide a very good description of the critical cells of the space C^nG, which are vital to understanding its topology. (Received August 23, 2004)