

Christopher Monteith: *Combinatorial isomorphism and partition backtracking*

The general problem of deciding combinatorial isomorphism – the problem of deciding whether two mathematical objects lie in the same orbit under a group action – is known to be difficult. Two examples are linear code equivalence and graph isomorphism, and they share a rare but annoying property: despite being almost certainly not NP-complete, both have foiled all attempts at a polynomial-time solution.

Due to these complexity theory issues partition backtrack algorithms have become the weapon of choice for attacks on combinatorial isomorphism problems. Although not polynomial-time, these algorithms provide practically acceptable performance on average. A popular implementation of such methods is the program *nauty*, which has been used extensively on graphs. This talk will explore the mathematics behind the main algorithm of *nauty* – with less emphasis on the algorithm and more emphasis on the group theory.