Martin Grohe
RWTH Aachen University

The Algebra of Homomorphism Counts

Representations of graphs based on counting homomorphisms provide a surprisingly rich view on graphs with applications ranging from database theory to machine learning. Lovász (1967) showed that two graphs G and H are isomorphic if and only if they are homomorphism indistinguishable over the class of all graphs, i.e., for every graph F, the number of homomorphisms from F to G equals the number of homomorphisms from F to H. Recently, homomorphism indistinguishability over restricted classes of graphs such as bounded treewidth, bounded treedepth and planar graphs, has emerged as a surprisingly powerful framework for capturing diverse equivalence relations on graphs arising from logical equivalences and algebraic equation systems.

In this talk, I will introduce an algebraic framework for such results drawing from linear algebra and representation theory.

This is joint work with Holger Dell, Gaurav Rattan, and Tim Seppelt.