A remarkable technique in finite semigroups, and its application to the algebra of relations

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A seminal 1997 article by Hall, Kublanovsky, Margolis, Sapir and Trotter (HKMST) unleashed a novel and surprisingly transparent method of translating group word problems into finite semigroups. Amongst other things, it was proved that the class of finite semigroups embedding into a completely 0-simple semigroup is not recursive. A wide range of further undecidability results relating to finite semigroups were subsequently established.

An ostensibly unrelated topic is that of relation algebra, which was initiated by Tarski in the 1940s and became one of the central topics in algebraic logic. Indeed, algebras of relations more generally form a fundamental interface between abstract algebra and computer science.

This talk will explain an application of the HKMST idea to problems of representability for reducts of Tarski's relation algebra. We will present an overview of the HKMST semigroup-theoretic technique and its embellishments, culminating in a sketch of a proof that representability and finite representability are undecidable for finite Boolean monoids and for finite lattice-ordered monoids.

This talk reports on joint work with M. V. VOLKOV (Ural State University, Ekaterinburg) and with R. HIRSCH (University College, London).