

Solving word equations in groups by recompression

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Abstract

In this talk I will present an algorithm for solving equations in free groups, in particular, the algorithm gives a finite graph-like representation of all solutions. In this representation the edges are labelled with morphisms and the solutions are obtained as compositions of morphisms on the path from the designated starting vertex to the designated ending vertex.

The main idea is to reduce the case of groups to semigroups (with regular constraints and involution) and then employ a simple technique of local recompression. The technique is based on local modification of variables (replacing X by aX or Xa) and iterative replacement of pairs of letters occurring in the equation by a ‘fresh’ letter, which can be seen as a bottom-up compression of the solution of the given equation. The crucial point of the analysis is that in this way we can keep the instance small, i.e. polynomial in the size of the input, thus guaranteeing termination of the whole procedure.

I will also discuss generalisations of this algorithms to some other groups, which for instance include RAAGs.