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**Ellen M Ziliak\***, eziliak@ben.edu, and **Alexander Hulpke**. *Rewriting using a Stalling Subgroup Graph.*

A Stalling Graph for a subgroup  $N$  is the directed graph obtained from the disjoint union of the paths in by identifying the root vertices. If we consider a finitely presented group  $G \cong F/N$ , then  $G$  can be thought of as a quotient group. Where  $G$  is a quotient of  $F$  a free group, and  $N$  is the normal closure of the subgroup generated by the relators given for  $G$ , we can construct a Stalling Subgroup Graph for  $N$ . It turns out that this graph includes all of the necessary information contained in the Cayley Graph for  $G$  that is used to rewrite words in  $F$  as a product of conjugates of the relators given for  $G$ . In this talk use the Stalling Subgroup Graph for  $N$  to give a more efficient algorithm to rewrite words in a finitely presented group as a product of conjugates of relators. As a practical application to this algorithm one can use it to do arithmetic in group extensions assuming the 2-cocycles are given. (Received December 09, 2010)