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A Fine-Grained Concurrent Completion Procedure

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We present a new parallel method for performing Completion, which has the following characteristics. The equations are stored in a graph, with maximal structure sharing. Each vertex in the graph represents a term and the edges represent the relations of subterm, rewriting, unification and orientation. The edges are labelled with constraints and renamings, and Basic Completion is performed on the graph as local graph transformations. In our concurrent model, each vertex is a process and the edges are communication links. Therefore, the parallelism is at the term-level, where the graph transformations have the effect of combining solutions. By the terminology of the Hsiang-Bonacina survey, our strategy is contraction-based, since we perform simplification. Therefore, we believe that our method is a step forward to refute the statement in their survey that only search-level parallelism is cost-effective for contraction-based systems. Because our graph transformations are local, there is no need for a global memory or a global control, which we believe is the main drawback of most parallel Completion and Theorem Proving procedures. Another benefit of the technique is that the message passing is asynchronous. There is no need to check for consistency, and no redundant work is performed.