A System for Distributed Simplification-Based Theorem Proving *
(Abstract)

Maria Paola Bonacina **Jieh Hsiang**
Department of Computer Science
SUNY at Stony Brook
Stony Brook, NY 11794-4400
{bonacina,hsiang}@sbcs.sunysb.edu

Our project consists in the design and implementation of *simplification-based* strategies [1] for parallel automated deduction, on a multi-processor with *distributed memory.* For equational logic the basic inference mechanism is an enhanced version of Unfailing Knuth-Bendix completion. Ordered resolution, ordered paramodulation and several contraction inference rules will be featured for first order logic with equality. We plan to develop a first prototype of our system, for equational logic, on an Intel hypercube. The extension to first order logic with equality will follow.

The basic idea in our approach is to have all processors, or *nodes*, *searching in parallel* for a proof of the input theorem. The processors have a high degree of *independence*: they are all peers, working asynchronously and cooperating by exchanging messages. In addition to the basic components of a theorem proving strategy, i.e. the *inference mechanism* and the *search plan*, our strategy features a *distributed allocation algorithm* and several policies for the *routing/broadcasting* of messages. The distributed allocation algorithm distributes among the nodes first the input equations and then those generated during the execution. Thus, at any stage of the derivation, each processor has its own, local data base of equations. The union of these data bases forms the global data base. The processors communicate by sending messages, either *data-messages*, containing equations, or *control-messages.* Each node is responsible for performing inferences by using the equations in its own data base and those received in form of messages. Data-messages are further classified depending on the status of the carried equation: for instance, newly generated equations are treated differently from normalized equations. Different message-handling policies are defined for the different types of messages.

We expect the highly distributed nature of this approach to help significantly in attacking the huge search spaces usually generated by theorem proving problems.

References

[1] M.P.Bonacina and J.Hsiang, Towards a Foundation of Completion procedures as Semidecision procedures, Technical Report, Dept. of Computer Science, SUNY at Stony Brook, available through ftp.

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