Optimal Tree Contraction and Term Matching on the Hypercube and Related Networks

Abstract:
An optimal tree contraction algorithm for the boolean hypercube and the constant degree hypercubic networks, such as the shuffle exchange or the butterfly network, is presented. The algorithm is based on novel routing techniques and, for certain small subtrees, simulates optimal PRAM algorithms. For trees of size $n$, stored on a $p$ processor hypercube in in-order, the running time of the algorithm is $O(\lceil \frac{n}{p} \rceil \log p)$. The resulting speed-up of $O(p/\log p)$ is optimal due to logarithmic communication overhead, as shown by a corresponding lower bound. The same algorithmic ingredients can also be used to solve the term matching problem, one of the fundamental problems in logic programming.

Stichworte:
parallel algorithms; hypercube; tree contraction; term matching; optimal speed-up

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