A unified method for placing problems in polylogarithmic depth. (English) Zbl 07278108

Summary: In this work we consider the term evaluation problem which is, given a term over some algebra and a valid input to the term, computing the value of the term on that input. In contrast to previous methods we allow the algebra to be completely general and consider the problem of obtaining an efficient upper bound for this problem. Many variants of the problems where the algebra is well behaved have been studied. For example, the problem over the Boolean semiring or over the semiring \((\mathbb{N}, +, \times)\). We extend this line of work.

Our efficient term evaluation algorithm then serves as a tool for obtaining polylogarithmic depth upper bounds for various well-studied problems. To demonstrate the utility of our result we show new bounds and reprove known results for a large spectrum of problems. In particular, the applications of the algorithm we consider include (but are not restricted to) arithmetic formula evaluation, word problems for tree and visibly pushdown automata, and various problems related to bounded tree-width and clique-width graphs.

For the entire collection see Zbl 1388.68010.

MSC:

68N30 Mathematical aspects of software engineering (specification, verification, metrics, requirements, etc.)

68Qxx Theory of computing

Keywords:
polylogarithmic depth; term evaluation; parallel algorithms

Full Text: DOI

References:


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