Feedback Guided Dynamic Loop Scheduling
A Theoretical Study

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Abstract

Loop structures represent an important source of parallelism in parallel programs. Several static and dynamic scheduling methods are currently available to exploit loop parallelism. Feedback Guided Dynamic Loop Scheduling (FGDLS) is a new algorithm that aims to schedule a sequence of similar parallel loops. The method uses feedback information from the previous parallel loop to improve load balancing of the current parallel loop. This thesis provides a theoretical investigation of the FGDLS algorithm.

Firstly, the thesis introduces a static scheduling algorithm called Balanced Workload Block Scheduling. This method uses a block scheduling to distribute equally the workload on the processors. Equations for the BWBS bounds are given when the workload is known. It is shown that FGDLS can be implemented by using a sequence of BWBS schedulings.

Secondly, the FGDLS method is studied in the continuous case where the loop iteration is (artificially) assumed to be a continuous variable. In this case a simple equation for the bounds is proposed. An $O(\log p)$ parallel algorithm is develop to implement the FGDLS scheduling in this case. Convergence is established provided that the workload does not vary much or is monotone. The same problems are investigated for the discrete case which is more realistic. In this case an $O(p + \log p)$ parallel computation is proposed for the upper bounds. Convergence is established only for the case when the workload decreases. Finally, application of FGDLS is given to solve two classical problems from Linear Algebra and Graph Theory.