Data-Dependency Graph Transformations for Instruction Scheduling

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Abstract

This paper presents a set of efficient graph transformations for local instruction scheduling. These transformations to the data-dependency graph prune redundant and inferior schedules from the solution space of the problem. Optimally scheduling the transformed problems using an enumerative scheduler is faster and the number of problems solved to optimality within a bounded time is increased. Furthermore, heuristic scheduling of the transformed problems often yields improved schedules for hard problems. The basic node-based transformation runs in O(ne) time, where n is the number of nodes and e is the number of edges in the graph. A generalized subgraph-based transformation runs in $O(n^2e)$ time. The transformations are implemented within the Gnu Compiler Collection (GCC) and are evaluated experimentally using the SPEC CPU2000 oating-point benchmarks targeted to various processor models.

Keywords: instruction scheduling, graph transformation, optimal scheduling