

Paper #4

Author: Erik Eckstein, Bernhard Scholz

Title: Addressing Mode Selection

Reviewer: Ilie Savga

Summary:

One of the most difficult tasks in compiler optimization is the selection of optimal addressing mode (AM) for the target processor architecture in the means of minimal code size and execution time. It becomes even more important when generating code for embedded CPUs with powerful addressing modes, like digital signal processors (DSP). The paper presents a novel approach for exploiting AMs of DSPs by providing a method for modeling the target's architecture AMs as cost functions and the actual algorithm that evaluates the model. The experimental results show the runtime improvements up to 60% and code-size reduction up to 50% that allows to claim the proposed optimization as of vital importance for architectures with complex addressing mode features.

The main contributions

The authors propose Addressing Mode Selection (AMS) – a compiler optimization that selects the optimal mode for addressing registers in the input program and allows for considerable minimizing of code size and execution time in cases of processor architectures with powerful addressing modes.

Merits and weaknesses

Basically, the paper is well written; still, some terminology is used without explanation. The core of the paper describes the proposed cost model for optimization; the provided model is flexible, i.e. allows to vary different optimization goals (e.g. runtime and code-size) as well as to define a wide range of addressing modes. In addition, the scope of the optimization is a whole control flow graph that represents a big advantage comparing to other similar optimization techniques. Another merit is that paper clearly shows how the optimization problem can be solved using an existing solver, once the problem was modeled. Finally, the discussion on experimental results proves the high efficiency of the proposed optimization technique for DSP processors with powerful addressing modes.

One weakness of the paper is that although referring some related similar work, it does not provide a deep and comprehensive overview of the research dedicated to AMS. Also, the paper title is quite general, but the actual work is done on the embedded CPU architectures only, namely DSP; hence, it is reasonable to narrow the paper's title a bit. In addition, the conclusion section is pretty weak in presenting the main concepts and contributions of the proposed optimization.

Numerical rating

Significance 8

Originality 7

Interest to a journal on programming languages and compiler technology 4

Quality of experimental evaluation 7

Overall organization 8

Presentation (style and language) 7

Length appropriate 8

References appropriate 9

Overall evaluation 7

Recommendation Weak accept

Confidence 3

Comments and suggestions for improvement:

- Although the paper has a well-thought structure, it contains specific technical concepts and terms without defining or explaining them. For example, in the abstract section you use the term “auto post-modification” that might be unknown for a reader. Moreover, the “addressing mode” – one of the main concepts the paper is based on - is not explained at all.

- It would be nice to have a short overview of some existing addressing modes, to show what is the “optimal” addressing mode for particular processor architecture and explain why it is so important for optimization.
- You refer to some similar works in the domain of optimization. Could you systemize and extend them a bit and show more clearly what are the advantages of your methodology comparing to existing ones.
- The paper title seems to be too general: all the work and discussion is done in the area of embedded CPU architectures, more precisely, DSPs. I think, it is natural to restrict a bit the title to reflect that.
- Please, extend the conclusion section with more details about the suggested techniques, at least you should mention the model creation and the algorithm used.