Optimizing Compilers for Modern Architectures

Description: Modern computer architectures designed with high-performance microprocessors offer tremendous potential gains in performance over previous designs. Yet their very complexity makes it increasingly difficult to produce efficient code and to realize their full potential. This landmark text from two leaders in the field focuses on the pivotal role that compilers can play in addressing this critical issue.

The basis for all the methods presented in this book is data dependence, a fundamental compiler analysis tool for optimizing programs on high-performance microprocessors and parallel architectures. It enables compiler designers to write compilers that automatically transform simple, sequential programs into forms that can exploit special features of these modern architectures.

The text provides a broad introduction to data dependence, to the many transformation strategies it supports, and to its applications to important optimization problems such as parallelization, compiler memory hierarchy management, and instruction scheduling. The authors demonstrate the importance and wide applicability of dependence-based compiler optimizations and give the compiler writer the basics needed to understand and implement them. They also offer cookbook explanations for transforming applications by hand to computational scientists and engineers who are driven to obtain the best possible performance of their complex applications.

The approaches presented are based on research conducted over the past two decades, emphasizing the strategies implemented in research prototypes at Rice University and in several associated commercial systems. Randy Allen and Ken Kennedy have provided an indispensable resource for researchers, practicing professionals, and graduate students engaged in designing and optimizing compilers for modern computer architectures.

Offers a guide to the simple, practical algorithms and approaches that are most effective in real-world, high-performance microprocessor and parallel systems.

Demonstrates each transformation in worked examples.

Examines how two case study compilers implement the theories and practices described in each chapter.

Presents the most complete treatment of memory hierarchy issues of any compiler text.

Illustrates ordering relationships with dependence graphs throughout the book.

Applies the techniques to a variety of languages, including Fortran 77, C, hardware definition languages, Fortran 90, and High Performance Fortran.

Provides extensive references to the most sophisticated algorithms known in research.

Contents:

Preface
Chapter 1 Compiler Challenges for High-Performance Architectures
Chapter 2 Dependence: Theory and Practice
Chapter 3 Dependence Testing
Chapter 4 Preliminary Transformations
Chapter 5 Enhancing Fine-Grained Parallelism
Chapter 6 Creating Coarse-Grained Parallelism
Chapter 7 Handling Control Flow
Chapter 8 Improving Register Usage
Chapter 9 Managing Cache
Chapter 10
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