Introduction to Reversible Computing

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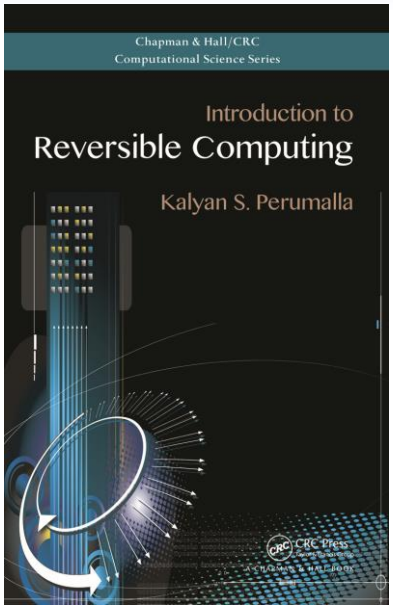

Collecting scattered knowledge into one coherent account, this book provides a compendium of both classical and recently developed results on reversible computing. It offers an expanded view of the field that includes the traditional energy-motivated hardware viewpoint as well as the emerging application-motivated software approach. It explores up-and-coming theories, techniques, and tools for the application of reversible computing. The topics covered span several areas of computer science, including high-performance computing, parallel/distributed systems, computational theory, compilers, power-aware computing, and supercomputing.

Key Features

- Emphasizes the software, programming, application, and usage aspects of reversible computing
- Helps readers easily understand complex theoretical and seminal results at a level suitable for senior undergraduate or graduate students
- Illustrates the development of reversible code generation using actual code segments in the C language
- Provides pseudocodes of several algorithms for memory-less or memory-efficient reversibility, including reversible random number generation and reversible numerical computation
- Includes a comprehensive bibliography and resources for further reading
- Offers source code for reversible random number generation and reversible models of abstract physical systems at www.rcbook.org

Selected Contents

INTRODUCTION: Scope. Application Areas. The Reversible Computing Spectrum. THEORY: Systems and Principles. Reversibility-Related Paradoxes. Theoretical Computing Models. Relaxing Forward-Only Execution into Reversible Execution. SOFTWARE: Reversible Programming Languages. Adding Reversibility to Irreversible Programs. Reverse C Compiler. Reversal of Linear Codes. Reversible Random Number Generation. Reversible Memory Allocation and Deallocation. Reversible Numerical Computation. Reversing a Sorting Procedure. Implementing Undo-Redo-Do. HARDWARE: Reversible Logic Gates. Reversible Instruction Set Architectures. SUMMARY: Future Directions. REFERENCES: Bibliography. Index.

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