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Systematic Methodology for Real-Time Cost-Effective Mapping of Dynamic Concurrent Task-Based Systems on Heterogenous Platforms

This material is mainly based on research at IMEC and its international university network partners in this area in the period 1997-2006. In order to deal with the concurrent and dynamic behaviors in an energy-performance optimal way, we have adopted a hierarchical system model (i.e., the gray-box model) that can both exhibit the sufficient detail of the applications for design-time analysis and hide unnecessary detail for a low-overhead run-time management. We have also developed a well-balanced design-time/run-time combined task scheduling methodology to explore the trade-off space at design-time and efficiently handle the system adaptations at run-time. Moreover, we have identified the connection between task-level memory/communication management and task scheduling and illustrated how to perform the task-level memory/communication management in order to obtain the design constraints that enable the this connection. A fast approach is also shown to estimate at the system-level, the energy and performance characterization of applications executing on the target platform processors.

Contents: 1: Introduction. 2: Related Work. 3: System Model and Work flow. 4: Basic Design-time Scheduling. 5: Scalable Design-time Scheduling. 6: Fast and Scalable Run-time Scheduling. 7: Handling of Multi-dimensional Pareto Curves. 8: Run-time Software Multithreading. 9: Fast Source-level Performance Estimation. 10: Handling of Task-level Data Communication and Storage. 11: Demonstration on Heterogeneous Multiprocessor SoCs. 12: Conclusions and future research work. References.

2007 230 p. Hardcover

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