

# Topic 4

## Compilers for High Performance (Compilation and Parallelization Techniques)

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### Presentation

This topic deals with all issues concerning the automatic parallelization and the compilation of programs for high-performance systems, from general-purpose platforms to specific hardware accelerators. This includes language aspects, program analysis, program transformation and optimization concerning the use of diverse resources (processors, functional units, memory requirements, power consumption, code size, etc.).

Of the 15 submissions, 5 were accepted as regular papers and 3 as research notes.

### Organization

The topic is divided into two sessions. The papers in the first session focus on locality.

- “Tiling and memory reuse for sequences of nested loops” by Youcef Bouchebaba and Fabien Coelho combines fusion, tiling, and the use of circular buffers into one transform, in order to improve data locality for regular loop programs.
- “Reuse Distance-Based Cache Hint Selection” by Kristof Beyls and Erik H. D’Hollander exploits the full cache control of the EPIC (IA-64) processor architecture, and shows how this allows to specify the cache level at which the data is likely to be found.
- “Improving Locality in the Parallelization of Doacross Loops” by María J. Martín, David E. Singh, Juan Touriño, and Francisco F. Rivera is an inspector/executor run time approach to improve locality of doacross loops with indirect array accesses on CC-NUMA shared memory computers; the basic concept is to partition a graph of memory accesses.
- “Is Morton array layout competitive for large two-dimensional arrays?” by Jeyarajan Thiyagalingam and Paul Kelly focuses on a specific array layout. It demonstrates experimentally that this layout is a good all-round option when program access structure cannot be guaranteed to follow data structure.

The second session is mainly dedicated to loop parallelization.

- “Towards Detection of Coarse-Grain Loop-Level Parallelism in Irregular Computations” by Manuel Arenaz, Juan Tourino, and Ramon Doallo presents an enhanced compile-time method for the detection of coarse-grain loop-level parallelism in loop programs with irregular computations.
- “On the Optimality of Feautrier’s Scheduling Algorithm” by Frédéric Vivien is a kind of meta paper: it shows that the well known greedy strategy of Feautrier’s scheduling algorithm for loop programs is indeed an optimal solution.
- “On the Equivalence of Two Systems of Affine Recurrences Equations” by Denis Barthou, Paul Feautrier, and Xavier Redon goes beyond parallelization of a given program; it presents first results on algorithm recognition for programs that are expressed as systems of affine recurrence equations.
- “Towards High-Level Specification, Synthesis, and Virtualization of Programmable Logic Designs” by Thien Diep, Oliver Diessel, Usama Malik, and Keith So completes the wide range of the topic at the hardware end. It tries to bridge the gap between high-level behavioral specification (using the Circal process algebra) and its implementation in an FPGA.

## Comments

In Euro-Par 2002, Topic 04 has a clear focus: five of the eight accepted papers deal with locality improvement or target coarse granularity. These subjects – even if not new – seem to become increasingly important, judging by their growing ratio in the topic over recent years.

Except for one paper, all contributions treat very traditional topics of compilers for high performance systems. This is a bit surprising since the topic call explicitly mentions other optimization goals. It seems that there is enough work left in the central area of high-performance compilation.

Furthermore, it is interesting to see that none of the proposed compilation techniques is specific to some programming language, e.g., Java, HPF, or OpenMP.

## Acknowledgements

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Also, we are very grateful for the excellent work of our referees: every submission (except for two, which have identically been submitted elsewhere, and were directly rejected) received four reviews, and many of the reviewers gave very detailed comments.

Last but not least, we also thank the organization team of Euro-Par 2002 for their immediate, competent, and friendly help on all problems that arose.