Theory and Algorithms for Parallel Computation

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Parallelism concerns all levels of current computing systems, from single CPU machines to large server farms. Effective use of parallelism relies crucially on the availability of suitable models of computation for algorithm design and analysis, and of efficient strategies for the solution of key computational problems on prominent classes of platforms, as well as of good models of the way the different components are interconnected. With the advent of multicore parallel machines, new models and paradigms are needed to allow parallel programming to advance into mainstream computing. This includes the following topics:

- foundations of parallel, distributed, multiprocessor and network computation;
- models of parallel, distributed, multiprocessor and network computation;
- emerging paradigms of parallel, distributed, multiprocessor and network computation;
- models and algorithms for parallelism in memory hierarchies;
- models and algorithms for real networks (scale-free, small world, wireless networks);
- theoretical aspects of routing;
- deterministic and randomized parallel algorithms;
- lower bounds for key computational problems;

This year, 8 papers discussing some of these issues were submitted to this topic. Each paper was reviewed by four reviewers and, finally, we were able to select 4 regular papers. The accepted papers discuss very interesting issues about theory and models for parallel computing, as well as the mapping of parallel computations to the execution resources of parallel platforms.

The paper "Analysis of Multi-Organization Scheduling Algorithms" by J. Cohen, D. Cordeiro, D. Trystram and F. Wagner considers the problem of scheduling single-processor tasks on computing platforms composed of several independent organizations where each organization only cooperates if its local make-span is not increased by jobs of other organizations. This is called 'local constraint'. Moreover, a 'selfishness constraint' is considered which does not allow schedules in which foreign jobs are finished before all local jobs are started. The article shows some lower bounds and proves that the scheduling problem is NP-complete. Three approximation algorithms are discussed and compared by an experimental evaluation with randomly generated workloads.

The paper "Area-Maximizing Schedules for Series-Parallel DAGs" by G. Cordasco and A. Rosenberg explores the computations of schedules for series-parallel DAGs. In particular, AREA-maximizing schedules are computed which produce

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execution-eligible tasks as fast as possible. In previous work, the authors have introduced this problem as IC-scheduling and have shown how AREA-maximizing schedules can be derived for specific families of DAGs. In this article, this work is extended to arbitrary series-parallel (SP) DAGs that are obtained by series and parallel composition.

The paper "Parallel selection by regular sampling" by A. Tiskin examines the selection problem and uses the BSP model to express a new deterministic algorithm for solving the problem. The new algorithm needs $O(n/p)$ local computations and communications (optimal) and $O(\log \log p)$ synchronizations for arrays of length n using p processors.

The paper "Ants in Parking Lots" by A. Rosenberg investigates the movement of autonomous units (ants) in a 2D mesh. The ants are controlled by a specialized finite-state machine (FSM); all ants have the same FSM. Ants can communicate by direct contact or by leaving pheromone values on mesh points previously visited. The paper discusses some movement operations of ants in 1D or 2D meshes. In particular, the parking problem is considered, defined as the movement to the nearest corner of the mesh.

We would like to take the opportunity of thanking the authors who submitted a contribution, as well as the Euro-Par Organizing Committee, and the referees with their highly useful comments, whose efforts have made this conference and this topic possible.