Foreword

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This special issue contains a group of four papers which are extended versions of those presented at the 18th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC) held in Timisoara, Romania in September 2016. The content of these papers reflect rather well the focus of the SYNASC symposium which is organized in six tracks corresponding to Symbolic Computation, Numerical Computing, Logic and Programming, Artificial Intelligence, Distributed Computing and Advances in the Theory of Computation.

The paper *Optimal Symmetry Breaking for Graph Problems* focuses on automating reasoning about graph problems. Such reasoning requires in general exploring and solving graph properties that are isomorphic, that is symmetric, to the graph problem under study. To avoid needless exploration of isomorphic subproblems in the search space while proving a given graph property, this paper studies symmetry breaking techniques and present several approaches to compute and analyze symmetry-breaking formulas. In particular, the paper introduces perfect/optimal approaches to symmetry breaking in SAT solving for graph problems of order up to five.

The paper *Using Machine Learning to Improve Cylindrical Algebraic Decomposition* illustrates how machine learning tools, particularly Support Vector Machine classifiers, can be used in deciding how to precondition Computer Algebraic Decomposition (CAD) problems in order to arrive to instances which can be solved efficiently. The approach is based on learning a matching between problem features and heuristics to be applied (e.g. choice of variable ordering) and its performance is experimentally illustrated for two case studies: (i) selection between heuristics for choosing a CAD variable ordering; (ii) identification of CAD problem instances which would benefit from Gröbner Basis preconditioning. This approach is amongst the first ones successful applications of Machine

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Learning tools in Symbolic Computation, and is a contribution to filling the gap between “problem” and “call this software”.

The paper *Processor Bounding for an Efficient Non-preemptive Task Scheduling Algorithm* includes results on the lower and upper bounds for the number of processors required to schedule both single-instance tasks and sets of periodic tasks. These bounds are further used to design a scheduling algorithm which combines ideas of two existing techniques (Earliest Deadline First and Least Laxity First) in order to exploit the benefits of each one.

The paper *Approximate polynomial GCD by approximate syzygies* does precisely what the title says. The approximate GCD problem asks for the greatest common divisor, not of f and g , but of polynomials “near” f and g that have a non-trivial GCD. For example $\gcd(x^2 + 2.001x + 1, x^2 - 1.001) = 1$, but $\gcd(x + 2 + 2x + 1, x^2 - 1) = x + 1$. The novelty of this paper is to adapt a recent algorithm for multivariate exact gcd, working by syzygies, to also solve the approximate problem. This works particularly well in the multivariate setting, as the examples show.

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