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Mathematics in Computer Science

Foreword

Sandra Di Rocco · Josef Schicho

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Since the appearance of special purpose software for the manipulation of polynomials and ideals, researchers have an increased capability of computing larger examples and testing conjectures. The topic of Computational Algebraic Geometry has emerged in connection with a number of related areas. Commutative algebra, geometry over the real numbers, algebraic number theory, differential geometry, group theory, Lie theory, algebraic statistics are just some examples. The nine contributions in this special issue give a representative cross section of the state-of-the-art research in this field.

The paper by B. Bastl et al. studies parameterization algorithms for rational ringed and canal surfaces. It introduces a unifying approach which is based on the fact that both classes of surfaces possess circles as parameter lines.

D. Bates and M. Niemerg communicate and explore an idea for handling the computational problems arising in homotopy continuation when two homotopy paths come close to each other.

The ring of $3 \times 3 \times 3$ arrays, under the action of $SL(3) \times SL(3) \times SL(3)$, is freely generated by three fundamental invariants denoted respectively by I_6, I_9, I_{12}. H. Bremner and L. Oeding provide an explicit expression of the hyperdeterminant as a polynomial in these fundamental invariants.

L. Buse and J.-P. Jouanalou wrote a fundamental treatise of discriminants associated to either 1 or $n - 1$ homogeneous polynomials in n variables. Based on the formalism of resultants, they develop a formalism with basic and deep theorems for these discriminants. All this is done on a level of generality so that it also applies to algebraic geometry or number theory.

Many important algebraic hypersurfaces are given by a parameterization rather than by an equation. J. Hauenstein and F. Sottile present an algorithm that numerically computes the Newton polytope of such a hypersurface.

M. El Kahoui and Z.Y. Moussa present an algorithm for computing a Gröbner basis for the ideal of adjoints of a plane algebraic curve and compare their method with existing ones.

B. Mourrain and N. Villamizar use techniques of homological algebra and algebraic geometry to obtain new bounds on the dimension of trivariate spline spaces.

S. Di Rocco (✉)
Department of Mathematics, KTH, 100 44 Stockholm, Sweden
e-mail: dirocco@math.kth.se

J. Schicho
RISC, University of Linz, 4040 Linz, Austria
e-mail: josef.schicho@jku.at

Q. Ren, S.V. Sam and B. Sturmfels give an explicit approach to tropicalization of moduli spaces by computing the tropical variety of classical algebraic varieties, such as the Segre cubic, the Igusa quartic, and marked del Pezzo surfaces.

The paper by D. J. Wilson et al. adapt the concept of cylindric algebraic decomposition used for variable elimination in algebraic equations over the reals. Their sub-decompositions may be faster to compute and sufficient to solve certain types of problems.

Each submitted paper has been reviewed by two independent referees. We would like to thank all authors and referees for their contribution.