

Some Challenges in Computational Algebraic Geometry

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There are many challenging problems and open questions in computational algebraic geometry. But the field also faces some challenges of a very different nature. My lecture will discuss three of these intriguing challenges. The first challenge is posed by users in other disciplines: when they use symbolic methods, how do we get them to take the computation seriously? I will illustrate the difficulty using a January 2000 article from the journal *Nature*. The second challenge concerns the question of what we mean by a computation. Is it an algorithm? A straight-line program? A determinantal formula? I will present several examples concerning resultants and Rees algebras to illustrate a range of what is encompassed by the term “computation.” Finally, I will discuss the challenge of loving bad algorithms. I don’t mean that we should love all bad algorithms, but rather that there are some essentially useless algorithms that nevertheless have a constructive role to play in computational algebraic geometry. In particular, I will discuss two of my favorite bad algorithms: one for factoring univariate polynomials with integer coefficients, and the other for solving Sudoku puzzles.