SOME EXAMPLES IN COMPUTATIONAL ALGEBRAIC GEOMETRY

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Systems of polynomial equations arise throughout mathematics, science, and engineering. Their solution sets are geometric objects which may be studied using algebraic means. Problems originating from this study are handled in algebraic geometry, a mathematical discipline of its own.

As a result of the historical development of algebraic geometry, there is nowadays a multitude of theoretical and highly abstract techniques for the qualitative and quantitative study of solution sets, without actually studying the equations at the first place.

The development of powerful computers and effective computer algebra algorithms at the end of the twentieth century, however, brings the study of concrete examples via their equations back to the center of interest. The novel computational methods make algebraic geometry accessible to experiments. The experimental method, which has proven highly successful in number theory, now also adds to the toolbox of the algebraic geometer.

In my talk, I discuss several examples of how explicit computations may help to do research in algebraic geometry. On my way, I will present code in two computer algebra systems, `Singular` and `Macaulay2`, discussing also some new features of these systems.