The DEWCAD Project: Pushing Back the Doubly Exponential Wall of Cylindrical Algebraic Decomposition

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Cylindrical Algebraic Decomposition (CAD), was developed by Collins in the 1970s. Originally it was introduced to perform quantifier elimination over reals; given a formula with some quantifiers on variables, CAD finds an equivalent form without quantifiers. However, CAD should really be considered as a general tool for working with subsets of $\mathbb{R}^n$ that can be described by polynomial equations and inequalities. It can be used in deciding the correctness, satisfiability, and various other properties of a given set of polynomial constraints (possibly with quantified variables). CAD has many applications in combinatorics and other research fields and good implementations of it is in high demand.

This presentation aims to introduce the ACA community to the DEWCAD project, which is based at Coventry University and the University of Bath, in the United Kingdom. The project seeks to push back the Doubly Exponential Wall of Cylindrical Algebraic Decomposition, through the integration of SAT/SMT technology, the extension of Lazard projection theory, and the development of new algorithms based on CAD technology but without producing CADs themselves. The project also seeks to develop more applications of CAD to various fields.

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