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A New Maple Package for Solving Parametric Polynomial Systems

A new Maple package `RootFinding[Parametric]` for solving parametric systems of polynomial equations and inequalities is described. The main idea for solving such a system is as follows. The parameter space $\mathbb{R}^d$ is divided into two parts: the discriminant variety W and its complement $\mathbb{R}^d \backslash W$. The discriminant variety is a generalization of the well-known discriminant of a univariate polynomial and contains all those parameter values leading to non-generic solutions of the system. The complement $\mathbb{R}^d \backslash W$ can be expressed as a finite union of open cells such that the number of real solutions of the input system is constant on each cell. In this way, all parameter values leading to generic solutions of the system can be described systematically. The underlying techniques used are Gröbner bases, polynomial real root finding, and Cylindrical Algebraic Decomposition. This package offers a friendly interface for scientists and engineers to solve parametric problems, as illustrated by an example from control theory.