

Algebra and Geometry of Polynomials: Theory and Applications

Bachir El Khadir

Princeton University

Department of Operations Research and Financial Engineering

By scaling variables and adding them together, we can construct any linear function. If we also allow the variables to be multiplied together, we then obtain polynomials. Even though this definition is algebraic in nature, the study of polynomial (in)equalities leads naturally to geometric objects, called semi-algebraic sets, and thus bridges the gap between the fields of algebra and geometry.

The investigation of the relationship between these two fields has a celebrated history, tracing back to Hilbert's work in the 19th century. In recent years, there has been a renewed interest in this topic because of the discovery of a connection to semidefinite programming, and the observation that numerous applications of modern interest can be cast as optimization problems over semi-algebraic sets.

In this talk, we give a gentle introduction to this interplay between algebraic geometry and optimization and present some of its applications.
