

## **A Knot between convex algebraic geometry and non-linear algebra**

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In convex algebraic geometry, a problem that has generated a lot of interest is the problem of determinantal representations of polynomials and these determinantal polynomials play a crucial role in semidefinite programming problems. In this talk, I shall discuss the problem of representing a multivariate real polynomial of (total) degree  $d$  as the determinant of a monic linear matrix polynomial whose coefficient matrices are either symmetric/ Hermitian matrices of order  $d$ . In particular, I shall talk about two methods to compute a monic symmetric/Hermitian determinantal representation for a bivariate polynomial if it exists. The first method transforms the determinantal representations problems into solving a system of polynomial equations by introducing the notion of generalized mixed discriminant of matrices. The techniques of matrix algebra and exterior algebra enable us to compute such a representation in the second method.