The talk concerns inequalities for functions having matrix variables. The functions are typically (noncommutative) polynomials or rational functions. A focus of much attention are the inequalities corresponding to convexity. Such mathematics is central to linear systems problems which are specified entirely by a signal flow diagram and L^2 performance specs on signals.

At this point we have:

(A) versions of the classical real algebraic geometry description of when one polynomial p is nonnegative on the domain where another polynomial q is nonnegative;

(B) classification of convex non-commutative polynomials, rational functions and varieties. Now we know that such matrix convexity typically forces the presence of some LMI;

(C) some theory of matrix convex hulls;

(D) some theory of changes of variables to achieve noncommutative convexity;

(E) other.

The talk will select a recent topic from this. The work originates in trying to develop some theory for studying the matrix inequalities which are ubiquitous in linear engineering systems and control. Most of the work is done jointly by J. William Helton, Igor Klep and Scott A. McCullough with parts having serious contributions by Jaka Cimprič, Chris Nelson and Markus Schweighofer.

The talks of Bill Helton and Igor Klep in this session are both on this topic and will be coordinated. No paper will be submitted to the proceedings.

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