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Noncommutative Inequalities. Preliminary report.

The talk will cover aspects of inequalities for non-commutative functions in free $*$ -algebras done with Igor Klep, Scott McCullough. At this point we have classifications of free convex rational functions and semialgebraic sets. There are shockingly few; all are identified with Linear Matrix Inequalities (LMIs). Now we undertake to develop a theory of change of variables to achieve matrix convexity. Our approach uses free $*$ -algebra versions of the classical real algebraic geometry Positivstellensatz and Nullstellensatz which have been developing over the last few years.

The work originates in trying to develop a theory suited to the matrix inequalities which are ubiquitous in linear engineering systems and control. The talk will be co-ordinated with Scott McCullough's talk, though his will focus on a bridge between traditional commutative LMIs and LMIs with matrix variables, a subject motivated by pursuits in the optimization community. (Received September 08, 2014)