



THE UNIVERSITY OF CHICAGO

COMPUTATIONAL AND APPLIED MATHEMATICS COLLOQUIUM

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Combinatorial Characterizations in Semidefinite Programming Duality: How
Elementary Row Operations Help

THURSDAY, October 17, 2019, at 4:00 PM
Jones 226, 5747 South Ellis Avenue

ABSTRACT

Semidefinite programs (SDPs) -- optimization problems with linear constraints and semidefinite matrix variables -- are some of the most useful, versatile, and exciting optimization problems of the last three decades. They generalize linear programs, and appear in combinatorial optimization, polynomial optimization, and control theory.

To solve SDPs, we rely on a natural dual problem. However, SDP duality is quite a messy affair: for example, SDPs may not attain their optimal value, and their optimal value may differ from that of their dual. Such SDPs are often difficult, or impossible to solve.

These pathologies occur, because the linear image of the cone of semidefinite matrices (a closed set) is not always closed.

I will show that many of these pathologies can be understood using a surprisingly simple tool: we can transform SDPs to normal forms that makes some of the pathologies trivial to recognize. The transformations mostly use elementary row operations from Gaussian elimination. The normal forms have computational uses, for example, in several cases they help us recognize infeasibility.

The talk assumes only knowledge of elementary linear algebra.

Some of this work is joint with Minghui Liu.

Organizer:

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