Center for Computational Mathematics Seminar

Xindong Tang, Graduate Student
UC San Diego

Generalized Nash Equilibrium Problems of Polynomials

Abstract:

The Generalized Nash Equilibrium Problem (GNEP) is a kind of games to find strategies for a group of players such that each players objective function is optimized, given other players strategies. If all the objective and constraining functions involved are polynomials, we call the problem a Generalized Nash Equilibrium Problem of Polynomials (GNEPP). When the constraining functions of each player are independent of other players strategies, the GNEP is called a (standard) Nash Equilibrium Problem (NEP). The GNEP is said to be convex if each players optimization is a convex optimization problem, given other players strategies.

For nonconvex Nash equilibrium problems that are given by polynomial functions, we formulate efficient polynomial optimization problems for computing Nash equilibria. We show that under generic assumptions, the method can find one or even all Nash equilibria if they exist, or detect nonexistence of Nash equilibria. For convex GNEPPs, we introduce rational and parametric expressions for Lagrange multipliers to formulate polynomial optimization for computing Generalized Nash Equilibria (GNEs). We prove that under some specific assumptions, the method can find a GNE if there exists one, or detect nonexistence of GNEs. Numerical experiments are presented to show the efficiency of the methods. The Moment-SOS hierarchy of semidefinite relaxations are used to solve the polynomial optimization.

Moreover, we study the Gauss-Seidel method for solving the nonconvex GNEPPs. We give a certificate for a class of GNEPPs such that the Gauss-Seidel method is guaranteed to converge, and the numerical experiments show that the Gauss-Seidel method can solve many GNEPPs efficiently.

Tuesday, April 20, 2021
11:00 AM
Zoom ID 939 3177 8552