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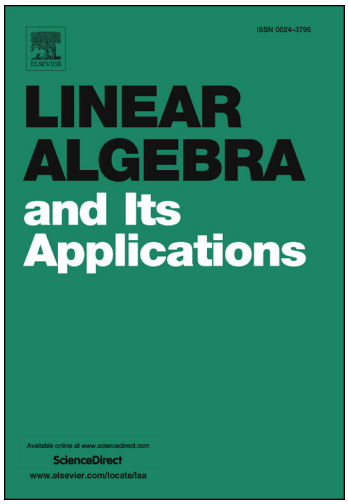

On symmetric linear games

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On symmetric linear games

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Abstract

In this paper, we generalize classical von Neumann symmetrization of two-person zero-sum games to general linear games. We use this symmetrization to show that for a given general linear game there exists a symmetric linear game whose solution yields a solution to the underlying linear game. We define symmetric linear games of type gRPS (generalized Rock-Paper-Scissors) and prove that a symmetric linear game has a pure strategy equilibrium if and only if it is not a gRPS game. From this we deduce that a completely mixed symmetric linear game is gRPS.

Keywords: `Zero-sum linear game`, `symmetric two-player game`, `Rock-Paper-Scissors game`, `pure equilibrium`, `tensor product`

2010 MSC: 91A05, 15A69, 46N10

1. Introduction

In [5], the concept of value of a two-person zero-sum game (zero-sum matrix game) is generalized to a linear transformation defined on a self-dual cone in a finite dimensional real Hilbert space. To elaborate, consider a finite dimensional real Hilbert space $(V, \langle\cdot,\cdot\rangle)$ and a self-dual cone K in V. For a fixed vector e in the interior of K, consider $\Delta := \{z \in K | \langle z, e\rangle = 1\}$ as the set of all strategies. Given a linear transformation $L : V \to V$, the zero-sum linear game denoted

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