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Supermodular interference suppression game for multistatic MIMO radar networks and multiple jammers with multiple targets

Key words: Supermodular game; Power allocation; Beamforming; MIMO radar; Multiple jammers

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Motivation

1. To deal with the threat of the new generation of electronic warfare, we establish a non-cooperative countermeasure game model to analyze power allocation and interference suppression between multistatic multiple-input multiple-output (MIMO) radars and multiple jammers.

2. Based on game theory, the jamming can be well suppressed by joint power allocation and beamforming.

3. The application of game theory to radar countermeasure will have great theoretical value.

Main idea

1. We establish two kinds of supermodular game frameworks for joint power allocation and beamforming (JPAB).

2. Based on game theory analysis, the best response functions of the radars and jammers are obtained.

3. The existence and uniqueness of the Nash equilibrium (NE) of the supermodular game are proved.

Method

Two kinds of supermodular game frameworks for joint power allocation and beamforming (JPAB) are established. One is a supermodular PAG framework with a fixed weight (FW) vector, and the other is a supermodular power allocation game (PAG) framework based on an optimal beamforming weight vector.

Major results

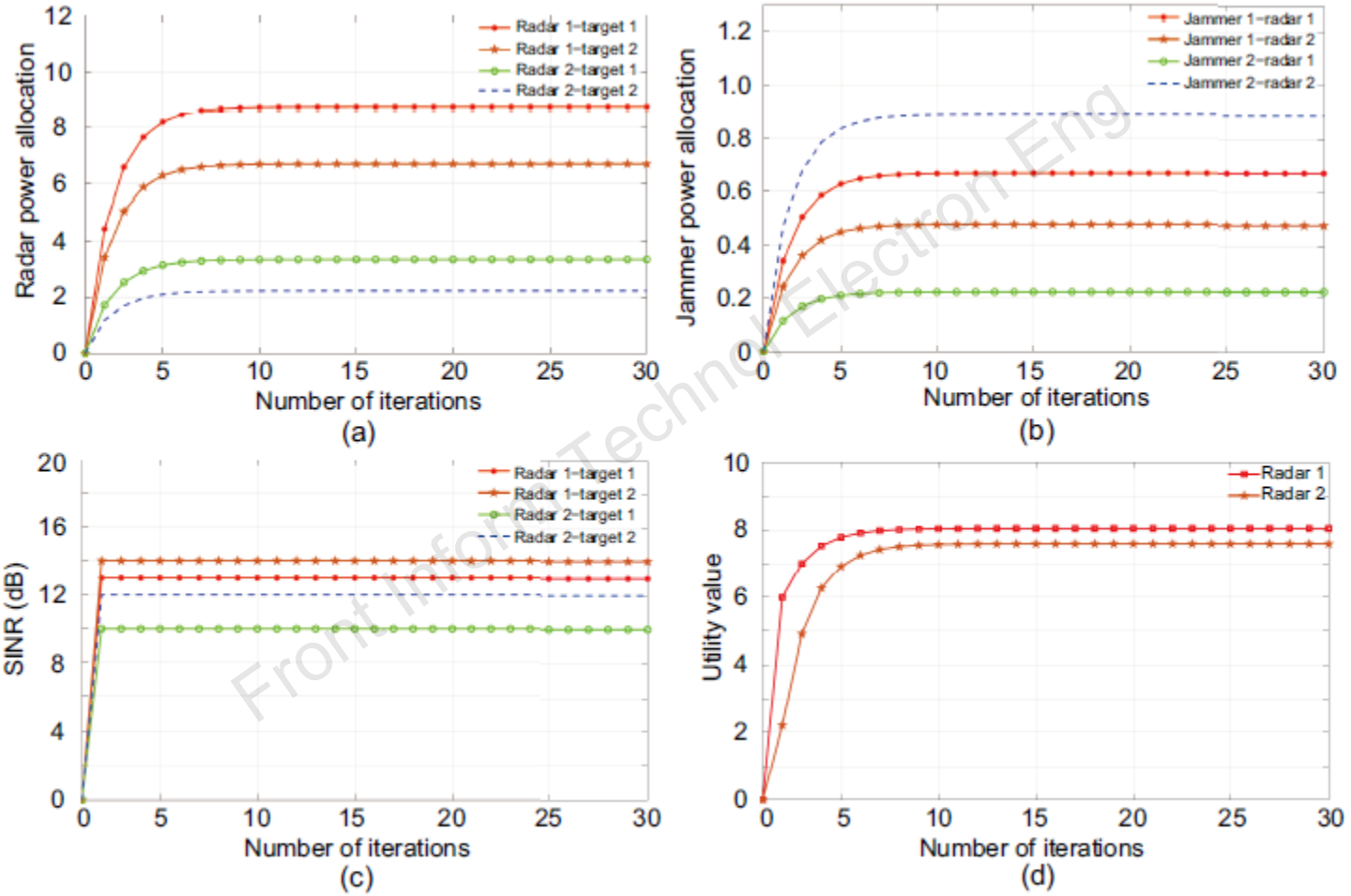

Fig. 3 Simulation results of the supermodular PAG algorithm with FW: (a) power allocation convergence for MIMO radars; (b) power allocation convergence for jammers; (c) SINR convergence for MIMO radars; (d) utility value convergence for MIMO radars

Major results (Cont'd)

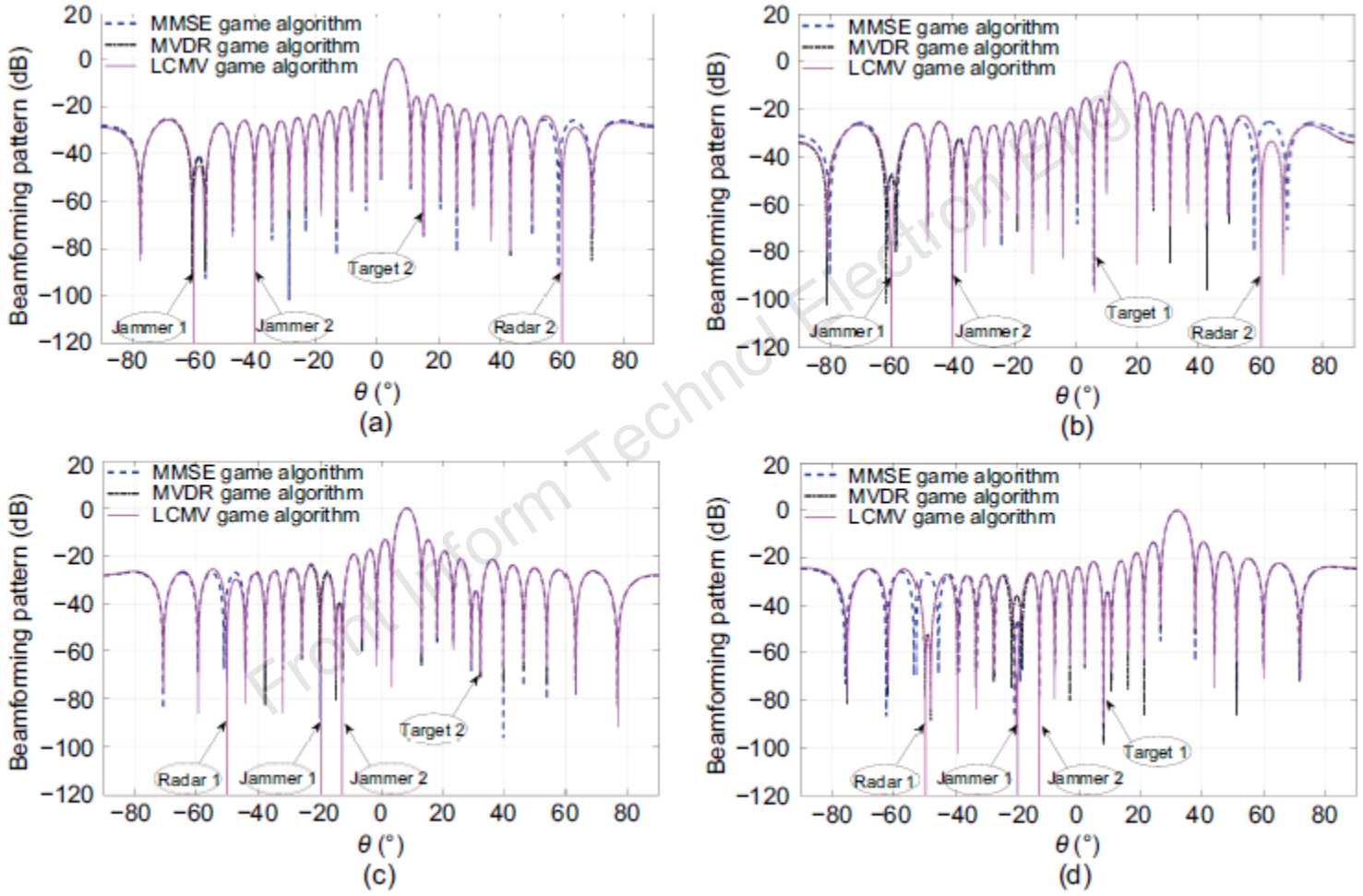

Fig. 4 Receive beampatterns: (a) the main beam of radar 1 pointing to target 1; (b) the main beam of radar 1 pointing to target 2; (c) the main beam of radar 2 pointing to target 1; (d) the main beam of radar 2 pointing to target 2

Major results (Cont'd)

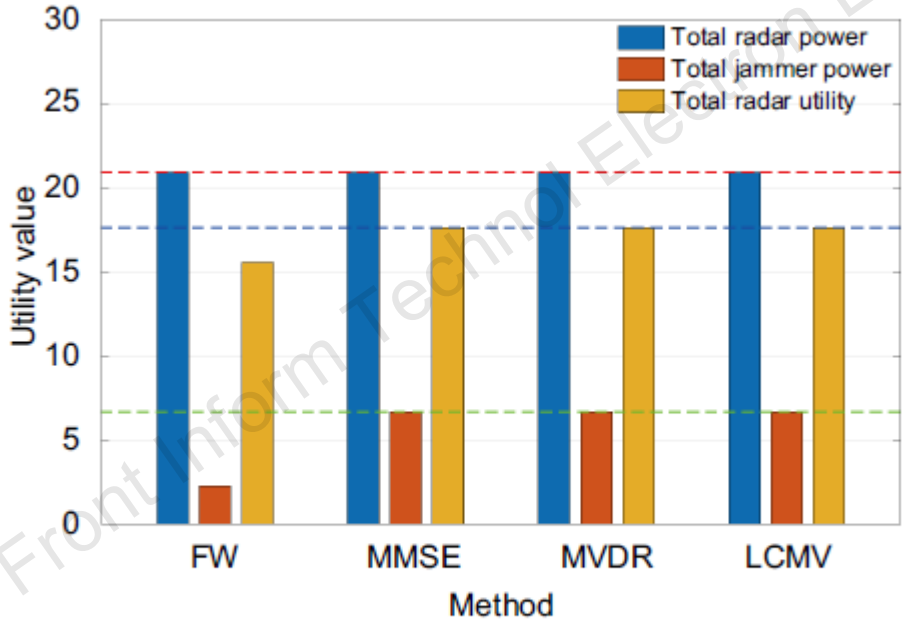

Fig. 5 Performance comparison of different algorithms

Conclusions

1. A supermodular game framework is established in which radars and jammers are the main players that carry out power allocation strategies.

2. Two supermodular game algorithms are proposed, and they converge to the NE.

3. The ability of interference suppression and the effectiveness and convergence of the proposed algorithms are verified.

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