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Sum Rate Maximization of Ad-Hoc Network in Adversarial Communication Environments: A Game-Theoretic Approach

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Abstract

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Abstract:

Recently, the hierarchical coalition-based Ad-hoc network (HCAN) has been adopted to establish link connection in adversarial environments. In this paper, a game-theoretic-based link access (GTLA) approach is proposed to maximize the sum rate of HCAN. Our scheme consists of two phases: the assignment between coalition head (CH) and coalition member (CM) as well as the matching between CH and disconnected node (DN). Firstly, the CH-CM assignment problem is formulated as a coalition formation game (CFG). It's proved that the CFG with the two-side best order is an exact potential game (EPG), which can significantly mitigate co-channel interference and hostile jamming. Secondly, the CH-DN matching problem is formulated as a bilateral many-to-one matching game. Then a partial mutual benefit order (PMBO) based matching algorithm with low computational complexity is designed to reconstruct broken links. Finally, simulation results are provided to verify the superior performance of our scheme.

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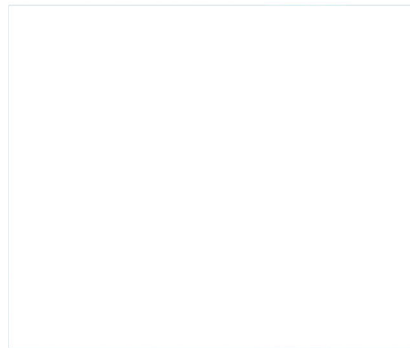






1. Introduction

In adversarial environments, the reconnaissance and monitoring tasks rely on robust communication networks. Pre-deployed and fixed networks are often destroyed due to hostile attack and malicious jamming and cannot provide satisfactory communication service for the legitimate nodes. Thus, the Ad-hoc network has been widely utilized for the advantages of flexible deployment and fast mobility, which can provide efficient network connection in adversarial environments. In particular, the hierarchical coalition-based Ad-hoc network (HCAN) is a promising architecture for task implementations, such as data collection and environment monitoring [1]. In HCAN, communication nodes are divided into multiple coalitions for special tasks. Each coalition consists of a coalition head (CH) and several coalition members (CMs).

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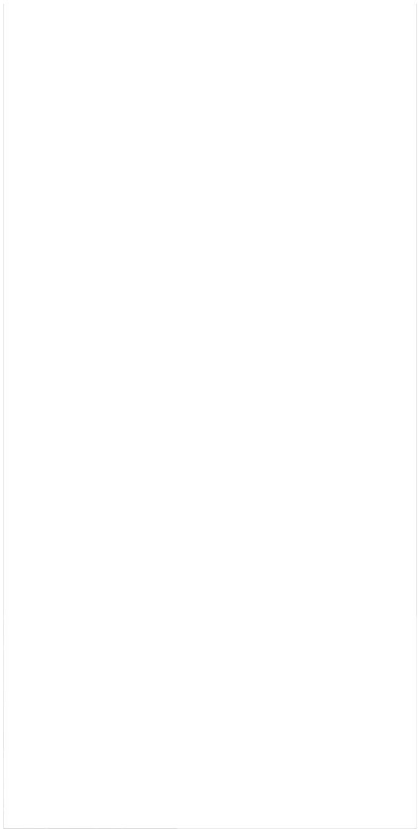
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