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Secure Energy Efficiency Maximization in Cognitive Satellite-Terrestrial Networks

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This article investigates the secure energy efficiency (EE) optimization problem in a cognitive satellite-terrestrial network with a capable eavesdropper. The objective is to maximize the secure EE for the primary satellite network while satisfying the allowable signal-to-interference-plus-noise ratio requirements of the secondary and primary users along within the transmit power limitation of both satellite and the terrestrial base station. Owing to the nonconvexity and intractability of the original optimization problem, a beamforming scheme and associated transformation algorithms are proposed by jointly applying the Taylor approximation, fraction programming, and alternating search to cope with the implementation difficulty. The key is to convert the original optimization problem into a simple convex framework and obtain the optimal solution step by step. Finally, numerical simulations are given to verify the feasibility and practicability of the proposed optimization algorithms.

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To overcome the drawbacks of terrestrial infrastructure with fair and high-quality services due to limited coverage areas, integrated satellite and terrestrial networks have been proposed in many fields for various applications, which are especially beneficial for users in rural or disaster-stricken scenarios [1], [2]. With the rapid development of multimedia and broadband services, the problem for spectrum scarcity is becoming severely urgent for both satellite and terrestrial networks. In this regard, various researchers propose the application of cognitive radio, which leads to an emerging architecture known as cognitive satellite-terrestrial networks (CSTNs) [3].

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