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## Cognitive radios power control game under Rayleigh slow fading channel

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**Abstract:** In cognitive radio networks, power control is considered to be a very important concern where secondary users, which are equipped with cognitive radios, try to access the unused spectrum of licensed primary users in an opportunistic way. Cognitive radios enable the secondary users to sense the presence of primary users and tune the channel (spectrum band) which is not in use at any time for its use. However, the interactions between secondary users are the only parameters which have been considered in most of the existing studies in this space, and the impact of primary user behaviors has been ignored. Hence, a novel realistic primary-secondary game-theoretic scheme is proposed in this study which rewards primary user for sharing its spectrum and allows secondary users to achieve energy-efficient transmissions. In general, the additive white Gaussian noise channel model is considered to be poor to describe the transmission channel and one must resort to more precise and realistic models such as fading channels. The proposed work here extends the fast flat fading models investigated in [1] and [2] to consider slow flat fading channels, where Rayleigh slow flat fading channel is analyzed and a closed-form expression is derived for the average utility functions. The existence and uniqueness of Nash equilibrium are also shown. Finally, detailed simulation results are presented to verify the performance of the scheme under realistic channel conditions compared to AWGN channel model.