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Performance of a primary-secondary user power control under Rayleigh fast flat fading channel with pricing

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Abstract: Power control is a crucial concern in cognitive radio networks where secondary users compete in an opportunistic way to access idle spectrum of primary users. However, most existing studies in this space have only looked at the interactions between secondary users, without considering the impact of primary user behaviors. In this study a novel realistic primary-secondary game-theoretic scheme with a linear pricing function is proposed to obtain a more efficient solution, which rewards primary users for sharing their spectrum to allow secondary users to achieve energy-efficient transmissions. The performance of the proposed realistic power control algorithm with pricing under Rayleigh fast flat fading channels is analyzed, where a closed-form expression is also derived for the average utility function. The existence of a unique Nash equilibrium is also shown and the numerical results are compared to both the realistic power control game model without pricing and to basic additive white Gaussian noise (AWGN) channel model.