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Performance of a primary-secondary user power control game for cognitive radios under Rayleigh fast fading channel

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Abstract: Power control is a crucial concern in cognitive radio networks where secondary users compete to access 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. Along these lines, this study proposes a novel realistic primary-secondary game-theoretic scheme which rewards primary users who share their spectrum and allow secondary users to achieve energy-efficient transmissions. The proposed model is analyzed for Rayleigh fast-fading channels where a closed-form expression is also derived for the average utility function. The existence of a unique Nash equilibrium is also shown. Finally, detailed simulation results are presented to verify the broader performance of the scheme under realistic channel conditions compared to the poor additive white Gaussian noise (AWGN) channel model.