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Transmit-power control for cognitive radio networks: Challenges, requirements and options

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Abstract

A critical design challenge for cognitive radio networks is to establish a balance between transmit power and interference. In recent years, several approaches for regulating the transmit power of secondary users in cognitive radio networks have been proposed. This report explores the challenges and requirements of power control in cognitive radio networks. The report details two algorithms that have attracted research attention, namely the iterative water-filling algorithm and the no-regret learning algorithm. The two algorithms are compared by considering their application to a simple model, given the same conditions and assumptions. Furthermore, an adaptive scheme is introduced. The scheme incorporates both algorithms into the design of the cognitive engine, which is the functional unit responsible for power control. The conceptual architecture of the cognitive engine is presented.

Simulation results for the iterative water-filling algorithm and the no-regret learning algorithm are presented. The number of iterations it takes for the algorithms to attain equilibrium are compared and used as a basis to establish the operational procedures of the hybrid-adaptive scheme. The operational procedures of the scheme are illustrated with a test application scenario. Several application scenarios are further presented to show how secondary users in cognitive radio networks can adaptively switch between the two operational strategies.