A Stochastic Power Control Game for Two-Tier Cellular Networks with Energy Harvesting Small-Cells

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ABSTRACT

To satisfy the ever-increasing number of cellular wireless service users and their high-rate communication requirements, the future generation cellular networks need to adopt multi-tier network architecture. In such architecture, the traditional macrocells will be overlaid with low-power small cells such as femto and picocells. New communication methods will be required in these networks to mitigate the effect of increased interference. Moreover, to achieve “green communication”, it is desirable that the wireless devices such as the small cell base stations (the number of which could be very large) use energy harvesting technology. Therefore, the communication protocols used in these devices need new designs such that the harvested energy is optimally utilized to achieve the communication objectives. In this research, I am investigating on designing distributed protocols for optimal energy management for the small cell base stations in a multi-tier cellular network. The objective is to satisfy QoS requirements for both macro and small base stations, considering randomness in the energy harvesting process as well as the interference dynamics in the network. For designing such protocols, tools from stochastic game theory will be used. These tools will provide solid mathematical basis for modeling, analysis, and optimization of the proposed protocols. The developed protocols will be compared with other popular methods using Markov Decision Process algorithms and on-line power control policies.

REFERENCES


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