Distributed Power Control for Time-Varying Wireless Networks: Optimality and Convergence

T. Holliday, N. Bambos, P. W. Glynn, and A. Goldsmith

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This paper presents a new distributed power control algorithm for ad-hoc wire- less networks in random channel environments. Previous work in this area has focused on distributed power control for ad-hoc networks with fixed channels. We show that the algorithms resulting from such formulations do not accurately capture the dynamics of a time-varying channel. The performance of the network, in terms of power consumption and generated interference, can be severely degraded when a power control algorithm designed for a deterministic channel is applied to a random channel. In particular, some well-known strong optimality results for such algorithms no longer hold. In order to address these problems we propose a new criterion for power optimality in ad-hoc wireless networks. We then show that the optimal power allocation for this new criterion can be found through an appropriate stochastic approximation algorithm. Ultimately, the iterations of the stochastic ap- proximation algorithm can be decoupled to form an optimal fully distributed on-line power control algorithm for ad-hoc wireless networks with time-varying channels.