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SIGNAL-TO-INTERFERENCE-BASED POWER CONTROL FOR WIRELESS NETWORKS: A SURVEY, 1992–2005 [1]

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Abstract. This paper summarizes and explains the main results on signal-to-interference (SIR) based power control algorithms, which are used to increase network capacity, extend battery life, and improve quality of service in cellular wireless radio systems. The classic works of Aein, Meyerhoff, and Nettleton and Alavi attracted considerable attention in the nineties. The modern approach to the power balancing control problem in wireless networks, formulated by Zander in 1992, matured in the papers of Foschini and Yates and their coworkers in the latter part of the nineties. However, the field is still wide open for research as is indicated by the increasing number of papers published in the area each year. The most recent approaches to solving the mobile power distribution problem in wireless networks use Kalman filters, dynamic estimators, and noncooperative Nash game theory.

Keywords. Power control, wireless communications, SIR-based power control, deterministic power control, stochastic power control.

AMS (MOS) subject classification: 93C05, 93C95, 94A99

1 Background and Conventions

Communication networks can be fixed or mobile; however, similar power control problems are common to both types. We will not concern ourselves here with the motion of mobile stations and hence will use the terms "mobile" and "user" interchangeably.

Information travels in two directions in a wireless network: uplink (mobile-to-base) and downlink (base-to-mobile). The mathematical formulations of these problems are similar in satellite communications; they differ in cellular wireless systems. In cellular communication networks, a concern specific to the uplink is conservation of mobile battery power. Also, downlink codes are synchronous and can be made orthogonal; but uplink codes arrive at the base station asynchronously, resulting in cross correlation, and hence high in-cell

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