

# Optimal Joint Rate and Power Allocation in CDMA Networks

R.J. Boucherie<sup>1</sup>, A.I. Endrayanto<sup>1</sup>, and A. F. Gabor<sup>2</sup>

<sup>1</sup> Faculty of Electrical Engineering, Mathematics and Computer Science,  
University of Twente, 7500 AE Enschede, The Netherlands

<sup>2</sup> Faculty of Mathematics and Computer Science and EURANDOM,  
Eindhoven University of Technology, 5600 MB, Eindhoven, The Netherlands

**Abstract.** In this paper we propose a polynomial time algorithm for the optimal rate and power allocation problem in a two cell CDMA network. We assume continuous rates and limited powers for the base stations.

## 1 Introduction

The inherent capacity restrictions due to scarce resources are fundamental problems in the operation of a wireless CDMA system. At the operational level (time scale of minutes), load fluctuations occur due to randomness in call generation and call lengths. At this time scale, load balancing is carried out via power and rate assignment as well as a reconfiguration of calls over cells. Power and rate assignment requires an underlying policy or network optimality criterion.

Common optimality criteria for CDMA network optimization are equal rate to all calls, or maximum total network data rate. Equal rates to all calls seems fair from a call perspective, but is rather inefficient in networks sustaining a normal load, mainly due to calls far away from base transmitter stations (BTS) causing a large amount of interference, and therefore a substantial reduction in network capacity. An important question in achieving maximum data rate is the assignment of data rates to individual calls. This assignment is clearly closely related to power assignment. This paper addresses, in an analytical setting, the joint power and rate assignment in two cells in a CDMA network.

**Literature.** The joint rate and power assignment problem for CDMA systems has received considerable attention over the last decades. Due to the complexity of the problems, several restrictions have been made, in order to obtain mathematically tractable models.

The most common simplifications are considering a cell in isolation, thus neglecting the interference effects, or assuming some extra properties of rates/powers, like unlimited rates or powers. For the simplified model of a *single cell* in isolation, down link power assignment schemes for maximizing the throughput or minimizing the total power in the cell are proposed in [8,5,12]. Resource assignment in a *multi cell* environment is more complex than in one cell, due to the interferences caused by users in adjacent cells. It has been studied in the framework of cell-breathing for fixed data rates, see e.g. the pioneering work of