Chapter 14

A COMBINATORIAL APPROXIMATION ALGORITHM FOR CDMA DOWNLINK RATE ALLOCATION

R.J. Boucherie[1], A.F. Bumb[1], A.I. Endrayanto[1] and G.J. Woeginger[2]

[1]*Stochastic Operations Research Group, Department of Applied Mathematics, University of Twente, P.O.Box 217, 7500 AE Enschede, the Netherlands. E-mail: {r.j.boucherie, a.f.bumb, a.i.endrayanto}@math.utwente.nl*

[2]*Combinatorial Optimization Group, Department of Mathematics and Computing Science, Eindhoven University of Technology, P.O.Box 513, 5600 MB, Eindhoven, the Netherlands. E-mail: gwoegi@win.tue.nl*

Abstract This paper presents a combinatorial algorithm for downlink rate allocation in Code Division Multiple Access (CDMA) mobile networks. By discretizing the coverage area into small segments, the transmit power requirements are characterized via a matrix representation that separates user and system characteristics. We obtain a closed-form analytical expression for the so-called Perron-Frobenius eigenvalue of that matrix, which provides a quick assessment of the feasibility of the power assignment for a given downlink rate allocation. Based on the Perron-Frobenius eigenvalue, we reduce the downlink rate allocation problem to a set of multiple-choice knapsack problems. The solution of these problems provides an approximation of the optimal downlink rate allocation and cell borders for which the system throughput, expressed in terms of utility functions of the users, is maximized.

Keywords: CDMA, feasibility transmit power, downlink rate allocation, multiple-choice knapsack, approximation scheme

1. Introduction

One of the most important features of future wireless communication systems is their support of different user data rates. As a major complicating factor, due to their scarcity, the radio resources have to be used very efficiently.