ABSTRACT

The uplink of code division multiple access (CDMA) cellular radio systems is often interference limited. The interference originates from many users whose transmission powers are not observable for the system. This thesis introduces uplink load and applies means of explicitly considering the users’ radio environment when approximating and controlling the load.

A desirable property of all cellular radio systems is uplink feasibility, i.e., existence of finite user transmission powers to support the allocated services. Uplink load can be considered as a measure of how far from infeasibility the system is. The performed characterization of uplink load lead to two concrete definitions related to the amount of received and transmitted power, respectively.

An important part of the total load is the intercell load which is caused by users connected to neighboring base stations. If not carefully handled, the intercell load can jeopardize uplink feasibility. Conversely, knowledge of a lower intercell load can be used to increase the resource assignments. A common denominator in all the work in this thesis is that the intercell load is explicitly considered.

When approximating uplink load, a centralized approach is adopted to study information gathered in several base stations. This yields good approximations of the average load. However, centralized approximations can not detect momentarily peaks in the load. A number of resource allocation algorithms making control decisions in the local base stations are proposed based on experience from characterizing uplink load. As the algorithms study the intercell load, yet without measuring the interference power, they are robust in the sense that they will never assign resources yielding an infeasible system.

A straightforward way of controlling the uplink load is to use measurements of the received interference power. This approach, just as the proposed load approximations, can gain from knowing the background noise power. The same framework used for designing robust resource allocation algorithms, is also used for estimating the background noise power.