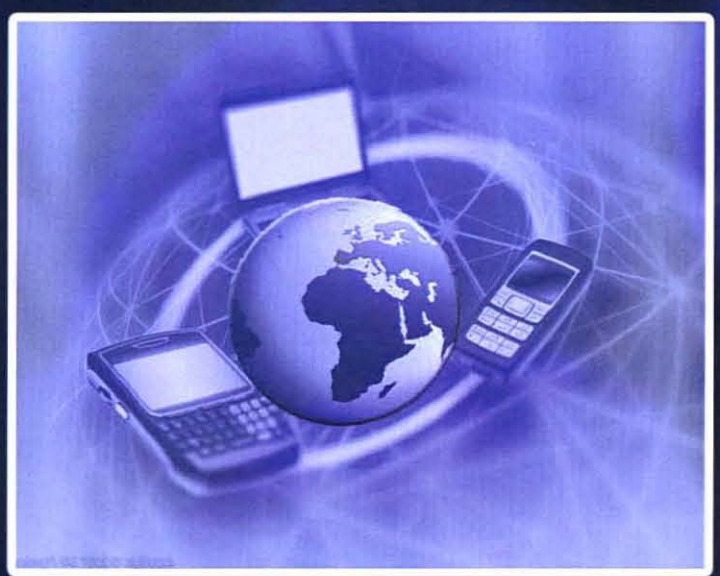
Research Issues in Wireless

Communications and Networking

Farhat Anwar
Wajdi Al-Khateeb



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CHAPTER 27

INTERFERENCE IN FEMTOCELL NETWORK

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27.1 INTRODUCTION

Femtocell network is a new technology that uses the advantage of an Internet backbone to enhance the cellular coverage in residential or small business areas. However, due to the expected random deployment of the femtocell access point (FAPs), there is a strong probability of interference among the femtocell nodes and between the femtocells and the macrocell nodes. In this chapter, an interference enhancement for multi-femtocells is developed and designed for two tiers macro-femtocell networks. An adaptive power control is calculated based on selecting the minimum interference channel with the optimized channel gain. In the simulation a number of the FAPs, the distance between the macrocell and the femtocell and the path loss between the macrocell node and the FAPs are used as design parameters. The results show a performance enhancement in the interference degradation ratio.

Femtocells are low-cost, miniature base-stations intended to improve the indoor coverage in the 3G networks and beyond. Femtocells are the smallest area that the network operator can cover to enhance the data rate in indoor coverage using a small base station. This is also known as a home base station (HBS) or a femtocell access point (FAP). The FAP is connected to an operator through a broadband/Internet network and uses licensed cellular bands. A FAP is small and inexpensive, and can transmit at a low power. It works on the licensed band and can be categorised based on the access method, an open access, where all the user of the same network can access the service and, a close access, where only the authorized personnel can access the service. A femtocell system is expected to increase a system capacity in terms of the number of users per cells or the data rate per user. This enhancement is due to a dedicated and an un-attenuated backhaul link using the fixed broadband i.e. DSL.

One of the main issues in adopting the femtocells en masse is the surge in interference to the mobile users served by the macrocell arising from unplanned networks and private access, which is similar to WiFi which has been deployed. A WiFi is using an unlicensed spectrum which uses a carrier sense technique while a femtocell is using a licensed cellular spectrum in which it shares the macrocell BS spectrum. In this circumstance, there will be a probability of interference between the macro-famto, and the femto-femto nodes. A femtocell has two access methods, namely, the open access or the close access modes. An open access mode is open for anybody to access the services after an initial authentication, the same as in the public WiFi. The non-authenticated user elements can access the macrocell BS. However, due to the close distance, FAPs can introduce a high interference to these users. The macrocell users can introduce interference to the femtocell users due to the high power usage. This interference reduces the performance of the FAP seriously if not intervened. Therefore, distributed power control mechanisms for the femtocells are essential to shield the existing users of the macrocell as well as to enable the scalable femtocell deployments. In this chapter we discussed the multicell interference problem and introduced an improved power control solution for the FAP to avoid an interference problem.