5G Ultra–dense Femtocell Networks Access: Issues and Challenges

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Abstract

Due to the popularity of data–hungry devices, like smart phones and tablets, the mobile operators towards the Fifth Generation (5G) are driven not only to increase their network capacity but also to boost the life of such battery operated wireless smart devices. One of the most feasible solutions to cope with this is the evolution from traditional macro–cell deployments to network densification. Small cells are seen as the best match for network densification, as they can be opportunistically deployed in the highly irregular way in hot spots. In consequence, the deployment of dense femtocell networks (DFNs) can be seen as an efficient spectrum utilization using new spectrum bands but subjected to inter–cell interference coordination particularly to cell–edge macro–users. Moreover, the decentralized architecture of the femtocell networks and the uncertainty in terms of the number and location of femtocell base stations increases the complexity of power control technique. This presentation will discuss inter–femtocell interference scenarios in a typical femtocell cluster together with an overview of some of the available interference management techniques. An interference mitigation schemes in indoor LTE–A femtocell network using a new simple fractional path–loss compensation power control technique utilizing local HeNBs information while maintaining QoS been proposed. Since densification of femtocells in an uncoordinated manner can lead to severe inter–femtocell interference, especially when they share the same channel and operate in Closed Subscriber Group (CSG) mode, a new Semi–virtual Clustering Scheme (SVCS) has been investigated. This scheme exploits users' status to categorize femtocells into the victim, aggressor or neutral and each victim femtocell is then partitioned into two virtual cells. Moreover, the scheme adapts dynamically to the status of each femtocell in the cluster, being either a victim or a safe femtocell and smartly estimates the proper partitioning (time or frequency) of resources within the defined clusters.

Keywords : femtocell, interference, 5G, power control, spectrum utilization.