



A Novel HGBBDSA-CTI Approach for Subcarrier Allocation in Heterogeneous Network

Mohammad Kamrul Hasan^{1,2} · Ahmad Fadzil Ismail² · Shayla Islam³ · Wahidah Hashim⁴ ·
Musse Mohamud Ahmed¹ · Imran Memon⁵

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Abstract

In recent times, Heterogeneous Network (HetNet) achieves the capacity and coverage for indoors through the deployment of small cells i.e. femtocells (HeNodeBs). These HeNodeBs are plug-and-play Customer Premises Equipment's which are associated with the internet protocol backhaul to macrocell (macro-eNodeB). The random placement of HeNodeBs deployed in co-channel along with macro-eNodeB is causing severe system performance degradation. Thereby, these HeNodeBs are suggested as the ultimate and the most significant cause of interference in Orthogonal Frequency-Division Multiple-Access based HetNets due to the restricted co-channel deployment. The CTI in such systems can significantly reduce the throughput, and the outages can rise to the unacceptable limit or extremely high levels. These lead to severe system performance degradation in HetNets. This paper presents a novel HGBBDSA-CTI approach capable of strategically allocate the subcarriers and thereby improves the throughput as well as the outage. The enhanced system performance is able to mitigate CTI issues in HetNets. This paper also analyses the time complexity for the proposed HGBBDSA algorithm and also compares it with the Genetic Algorithm-based Dynamic Subcarrier Allocation (DSA), and Particle Swarm Optimization-based DSA as well. The key target of this study is to allocate the unoccupied subcarriers by sharing among the HeNodeBs. The reason is also to enhance the system performance such as throughput of HeNodeB, the average throughput of HeNodeB Users, and outage. The simulation results show that the proposed HGBBDSA-CTI approach enhances the average throughput (92.05 and 74.44%), throughput (30.50 and 74.34%), and the outage rate reduced to 52.9 and 50.76% compare with the existing approaches. The result also indicates that the proposed HGBBDSA approach has less time complexity than the existing approaches.

Keywords OFDMA resource optimization · Computational complexity · Subcarrier allocation · Co-tier interference · Heterogeneous network

1 Introduction

In Heterogeneous Network (HetNet), the co-channel deployment is used to increase the capacity and the efficiency through high spatial frequency reuse. However, co-channel deployment in macro-eNodeB and HeNodeBs resulted in Co-Tier Interference (CTI), which also became one of the key challenges in HetNets [1–3]. In HetNet, the CTI occurs when adjacent HeNodeBs use the same subcarriers. The CTI issue happens when HeNodeBs are surrounded by each other, as well as when surrounded by HUEs. Figure 1 illustrates the CTI scenario, where the number of HeNodeBs and HUEs are depicted. CTI is a serious issue where it can be the ultimate interruption on OFDMA system and thereby causing unexpected service disruption and low throughput [4–6]. The CTI is consigned based on the unwanted signals received

✉ Mohammad Kamrul Hasan
hmkamrul@unimas.my

- ¹ Department of Electrical and and Electronics Engineering, Universiti Malaysia Sarawak (UNIMAS), 94300 Kota Samarahan, Sarawak, Malaysia
- ² Department of Electrical and Computer Engineering, International Islamic University Malaysia, 50728 Kuala Lumpur, Malaysia
- ³ Department of Computer Science and Engineering, Green University of Bangladesh, Dhaka, Bangladesh
- ⁴ Institute of Informatics and Computing in Energy, Universiti Tenaga Nasional (UNITEN), 43000 Kajang, Malaysia
- ⁵ College of Computer Science, Zhejiang University, Hangzhou, Zhejiang, China