論文 / 著書情報
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題目(和文)	将来セルラシステムに向けたヘテロジニアスネットワークと基地局協調伝送の組み合わせに関する研究
Title(English)	Study of Heterogeneous Networks and Cooperative Transmissions toward Future Cellular Systems
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

専攻： Department of	電気電子工学　専攻	申請学位（専攻分野）： Academic Degree Requested	博士（学術） Doctor of
学生氏名： Student's Name	下平 英和	指導教員（主）： Academic Advisor(main)	阪口 啓
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

The cellular networks have been developed for about 40 years and a new style of wireless communications has been provided together with its evolution. This evolution made the wireless communication more attractive, i.e. people have been able to not only talk but also exchange any types of digital data ubiquitously. However, in order to realize these targets, it is inevitable to achieve higher throughput. Indeed, the history of cellular network evolution is also the struggle to attain high throughput. First of all, the modulation scheme was changed from analog to digital to achieve higher spectral efficiency. Then the cell size was shrunk and the multiple access scheme was also changed to more effectively provide wireless resources to users. Multiple-Input Multiple-Output (MIMO) technique was also introduced to gain higher throughput. These evolutions are mainly related to improving access links' communication qualities. In recent year, to achieve further higher throughput, it becomes essential to improve network topology. Two technologies are employed, coordinated multi point transmission (CoMP) and heterogeneous networks. CoMP can alleviate inter cell interference by coordinating with neighboring cells. Ultimately, CoMP can completely eliminate inter cell interference and can turn it into useful signal, i.e. multi point MIMO transmission can be operated. On the other hand, heterogeneous network is constructed with conventional large coverage cells and small coverage add-on cells (small cells). These small cells are basically deployed near the congestion area (hotspot). The future cellular networks consider to utilize new frequency band above 6GHz for small cells. Since the radio wave in higher frequency band is easier to attenuate than that of conventional band, cell size becomes smaller and cell density becomes denser. Therefore, CoMP technique would play a key role for the interference mitigation. Although there are many candidate bands above 6GHz for future cellular networks, there were not so many investigations on that which frequency band is best for future cellular networks and what is the best combination of each frequency band and CoMP scheme.

This thesis aims to investigate the best deployment strategy of heterogeneous network and cooperative transmission to realize future cellular systems. Chapter 2 investigates the optimal smallcell BS deployment in heterogeneous cellular networks especially with the existence of hotspots. Smallcell BS locations are optimized together with other network parameters including spectrum resource allocation and smallcell size to maximize the fairness utility function, by considering two spectrum allocation strategies, i.e. spectrum overlapping and spectrum splitting. Numerical results show that the optimal smallcell BS locations depends on the hotspot user throughput and this optimization can improve the system rate, the average user rate and outage user rate in heterogeneous cellular network with hotspots. Chapter 3 analyses the relationship between CoMP scheme and frequency. In lower frequency band, the signal can be transmitted to wide area. However in higher frequency band, the signal is transmitted only within small area because large number of antenna elements are used for pathloss compensation by forming narrow beam. According to this nature, CoMP JT is more effective in lower frequency bands and CoMP CS/CB is more effective in higher frequency bands. This chapter reveals this relationship and proposes the best deployment strategy of cooperative transmissions in terms of frequency. Chapter 4 introduces the best combination with CoMP and heterogeneous network in lower frequency band. Smallcell BSs are introduced to solve the cluster edge problem in CoMP cellular networks. In our novel cell topology, we derive the optimal locations of small power base stations and the optimal resource allocation between the CoMP base station and small cell BSs to maximize the user fairness. By using the proposed architecture, in the case of perfect user scheduling, more than 150% improvement in 5% outage throughput is achieved, and in the case of successive proportional fair user scheduling, nearly 100% improvement of 5% outage throughput is achieved compared with conventional single cell networks. Chapter 5 shows the performance of heterogeneous network with cooperative transmission in higher frequency band. In this scenario, the heterogeneous network becomes multiband therefore a novel cell association method which is suitable for multiband heterogeneous network is introduced. In the numerical evaluation, 28GHz, 60GHz, and 73GHz are analyzed and the performance of each band is indicated according to the numerical simulation results. Finally, Ch. 6 concludes the thesis.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
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