

CELL ASSOCIATION FOR ULTRA-DENSE COMMUNICATION NETWORKS

Ali Serdar Yurtcan, Yasemin Güney Supervisor: Dr. Barış Yüksekkaya Hacettepe University Electrical and Electronics Engineering

Introduction

- One of the important issues in infrastructure-based multi-cell wireless networks is properly associating mobile user equipments (UEs) to the serving Base Stations (BS).
- ✤ In a wireless network with dense deployment of the BSs, the number of potential BSs with which a UE can be associated is increased. The network densification necessitates the need for designing optimal and distributed cell association schemes. This is because, if the UEs are not properly associated with BSs, it may result in increased interference, inefficient energy consumption, and load imbalance, in uplink and/or downlink

Application Areas

This project's goal is to model the new generation GSM systems but since intereference issue is main problem here, the logic behind the solution of this problem could be used in any wireless network system.



T Ü B İ T A K

Results and Discussion

Specifications and Design Requirements

For a realistic simulation the optimization problem requires to be $x_{i,1}SINR_{i,1} + x_{i,2}SINR_{i,2},$ $x_{i,1}SNR_{i,1} + x_{i,2}SNR_{i,2},$ solved: $x_{i,k} \in \{0,1\}, \qquad \forall i,k, \qquad x_{i,k} \in \{0,1\}, \\ \sum_{k=1}^{2} x_{i,k} = 1, \qquad \forall i. \qquad \sum_{k=1}^{2} x_{i,k} = 1, \end{cases}$ $\forall i, k,$ $\forall i$.

After that a realistic Path Loss shall be considered:



Solution Methodology

* Path Loss and Multipath Fading: Signals propagating through free space experience a power loss proportional to the square of the distance from the source. In reality, however, the signal travels through both a direct path and an indirect, reflective path, the loss increases with the fourth power of the distance





* Rayleigh Distribution: Transmitted signals are attenuated and phase shifted during the transmission. This channel effect can be modeled by complex channel coefficients

Solution Steps:

stations.

1-MATLAB was used for solving SINR and SNR optimization problems

2-Again, a path loss algorithm was created through MATLAB 3-Finally, a network area which contains multiple users and base stations was created

4-After the optimization problems were solved, Rayleigh channel coefficients were created and final SNR and SINR values were identified as signal power for connection between users and base



-150 x-coords(meter)

Through comparing SINR values, a realistic multi user communaciton network with high accuracy rate could be created.

References

Liu, J., Lin, C. and Huang, H., 2020. Joint Congestion Control And Resource Allocation For Energy-Efficient Transmission In 5G Heterogeneous Networks.

Nasimi, Meysam & Hashim, Fazirulhisyam and Ng, Chee Kyun. 2012. Characterizing Energy Efficiency for Heterogeneous Cellular Networks. 198-202. 10.1109/SCOReD.2012.6518638.

Nyarko, J. and Mbom, C., 2018. A Performance Study of Massive MIMO Heterogeneous Networks with Ricean/Rayleigh Fading. *Electronics*, 7(6), p.79. http://dx.doi.org/10.3390/electronics7060079.

Acknowledgements

• We thank DR. BARIŞ YÜKSEKKAYA for his invaluable contributions to

