

Frequency Re-Use Distance Calculation in Cellular Systems Based On Monte-Carlo Simulation

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Abstract

Radio spectrum's sharing guideline is an essential component of spectrum utilization process. Since there is no insightful interference avoidance method in a radio system, the careful selection of sharing conditions is the only means for achieving successful co-existence and optimal spectrum usage in the radio system. Spectrum sharing rule can be obtained by an analytical method or statistical method. The analytical method considers the worst-case scenario to calculate sharing rules. Nonetheless, this doesn't represent the lasting phenomenon amid ordinary task; moreover, sharing rules may be unnecessarily rigid. Henceforth, the Monte Carlo Simulation (MCS) strategy has been utilized to establish a probability of interference based on a random distribution of victim link receiver in time and space with respect to victim link transmitters.

The study has been done for cluster number N with values of 1, 3, 4, and 7 in a cellular system. Monte Carlo Simulation analysis showed the percentages of interference are 24.94%, 9.36%, 3.33%, and 0.4% for $N = 1$, $N = 3$, $N = 4$, and $N = 7$ respectively. In terms of throughput per total bandwidth per a single site, $N = 7$ offers a spectrum utilization of $1/7$ and $N = 4$ offers a spectrum utilization of $1/4$. Therefore, a relative enhancement in capacity of $7/4$ has been achieved with 3.3% probability of interference which is below the threshold value of 5%.

Heliyon Vol.5(3)pp.1-18 (2019)

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