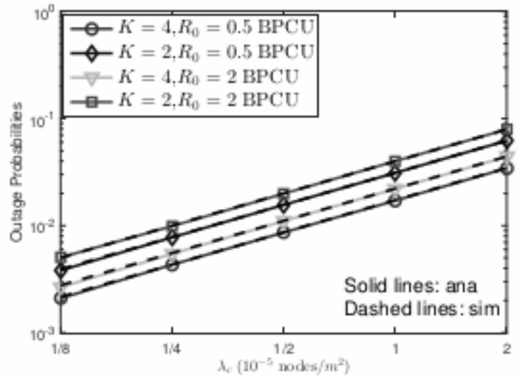


Fig. 3: Outage probabilities achieved by the NOMA user. $R_i = 1.5$ BPCU, $N = 10$.

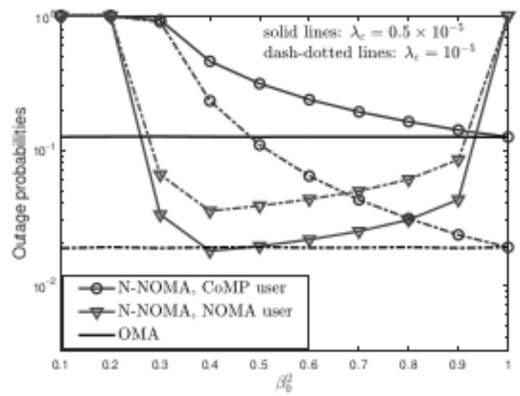
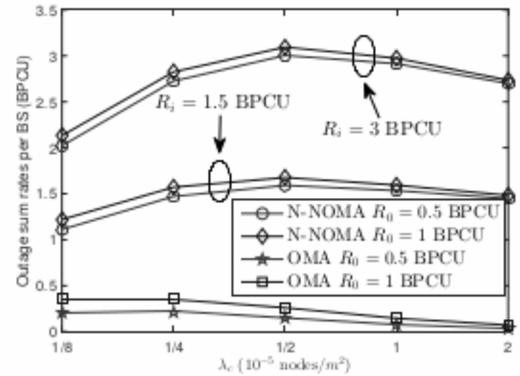
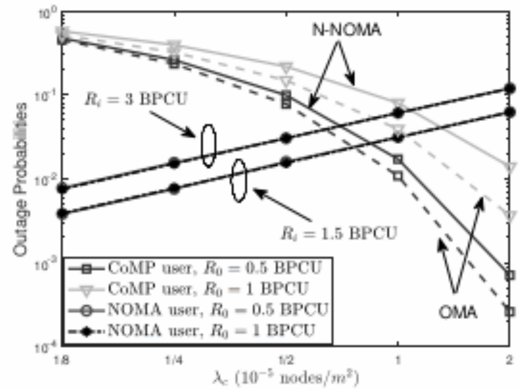


Fig. 4: Impact of power allocation coefficients on outage probabilities. $R_0 = 0.5$ BPCU, $R_i = 3$ BPCU, $K = 2$.



(a) Outage sum rates per BS



(b) Outage probabilities

Fig. 5: Comparison between N-NOMA and OMA. $K = 2$.

served. Fig. ??(a) shows the outage sum rate per BS achieved by N-NOMA and OMA, and Fig. ??(b) shows the corresponding outage probabilities achieved by these schemes. The outage sum rate per BS is given by: $\frac{(1-P_0^{out})R_0}{\lambda_c\pi(\mathcal{R}_\mathcal{D}^2-\bar{\mathcal{R}}^2)}+P(M>0)(1-P_i^{out})R_i$, where $\lambda_c\pi(\mathcal{R}_\mathcal{D}^2-\bar{\mathcal{R}}^2)$ denotes the average number of cooperating BSs in ring $\mathcal{C}$. Fig. ??(a) shows that the outage sum rate per BS achieved by N-NOMA is much higher than that of OMA. However, as shown in Fig. ??(b), the increase of sum rate achieved by N-NOMA is at the expense of a bit outage performance loss compared to OMA. Thus, the condition of applicability for N-NOMA is that when the CoMP user can tolerate a bit reliability loss compared to OMA. It also shows that the outage sum rate per BS doesn't keep increasing as λ_c increases. Because when λ_c is large enough, the outage probability of the CoMP user approaches zero, and the outage probabilities of NOMA users will increase with λ_c, which results in low rate.

V. Conclusion

In this paper, the application of N-NOMA to a downlink CoMP system has been studied. Stochastic geometry has been applied to model the random locations of communication nodes, based on which the outage performance of the proposed N-NOMA scheme has been evaluated. It has been shown that, by applying N-NOMA, the outage sum rate can be significantly improved compared to conventional OMA based CoMP scheme. It is noteworthy that perfect fronthaul/backhaul capacity has been assumed in this paper, and taking the impact of limited fronthaul/backhaul capacity on performance analysis into consideration will be an interesting future extension for this paper. Moreover, due to the complexity of the analytical results, corresponding optimization hasn't been considered to further improve the performance. Thus, finding proper approximations to give succinct expressions for the outage probabilities to further optimize parameters, such as $\mathcal{R}_\mathcal{D}$ and λ_c, is also left as an important future work.