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Capacity analysis for cognitive heterogeneous networks with ideal/non-ideal sensing

Key words: Cognitive heterogeneous networks, Markov chain, stochastic geometry, Homogeneous Poisson point process (HPPP)

Contact: Jiang LIU,
E-mail: liujiang@bupt.edu.cn
ORCID: http://orcid.org/0000-0002-0729-1299

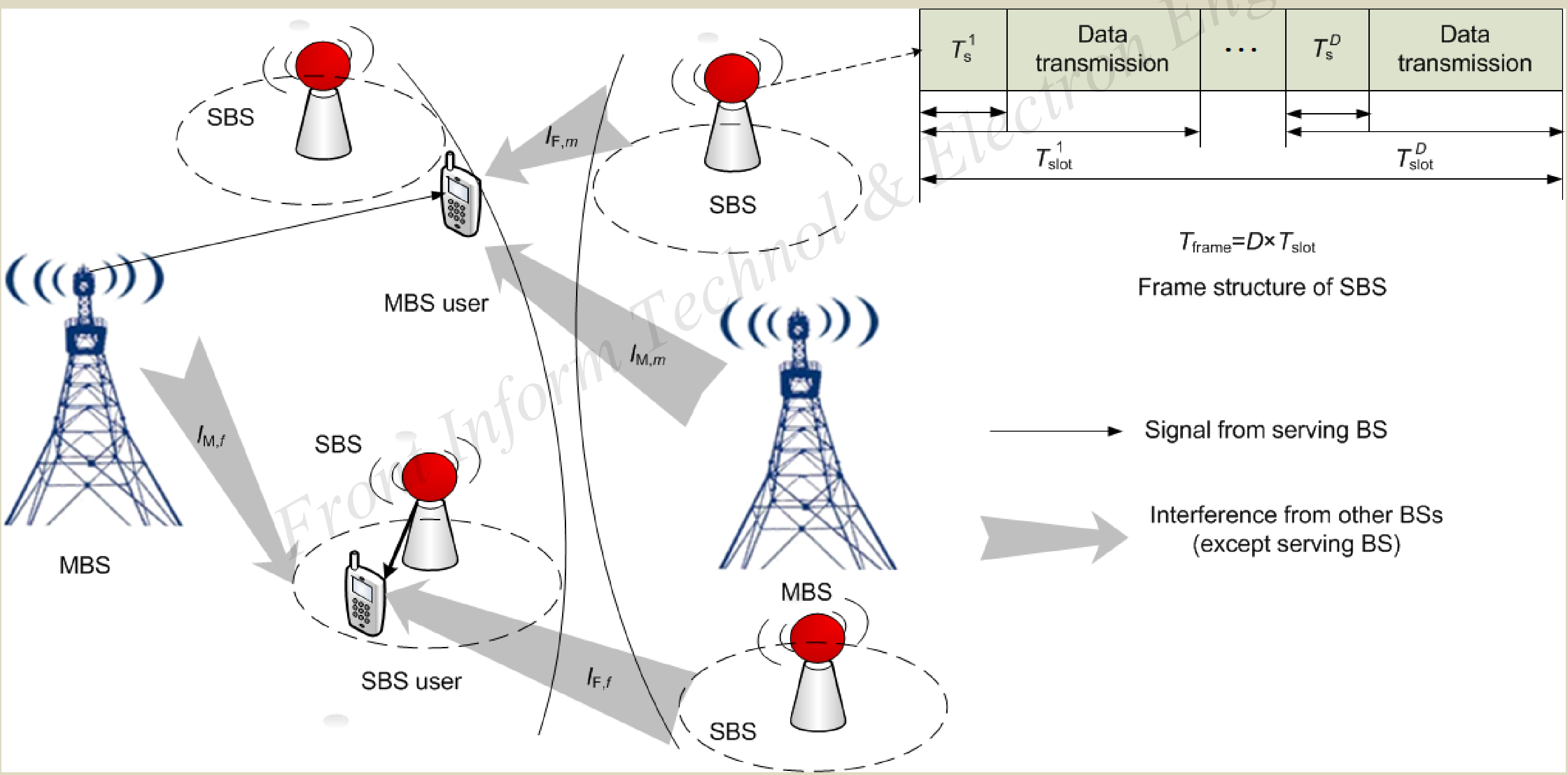
Introduction

- Cognitive radio brings tremendous spectrum usage, which is able to solve the spectrum usage and interference management.

- There are rare ones that can provide the closed-form network capacity expression for cognitive heterogeneous networks (CHNs) because of the interference and complicated network association, especially when the spectrum mobility is involved in the performance analysis.

- A closed-form expression for the capacity of CHNs is proposed based on the SG theory in this paper.

Illustration of a two-tier heterogeneous network



Network model

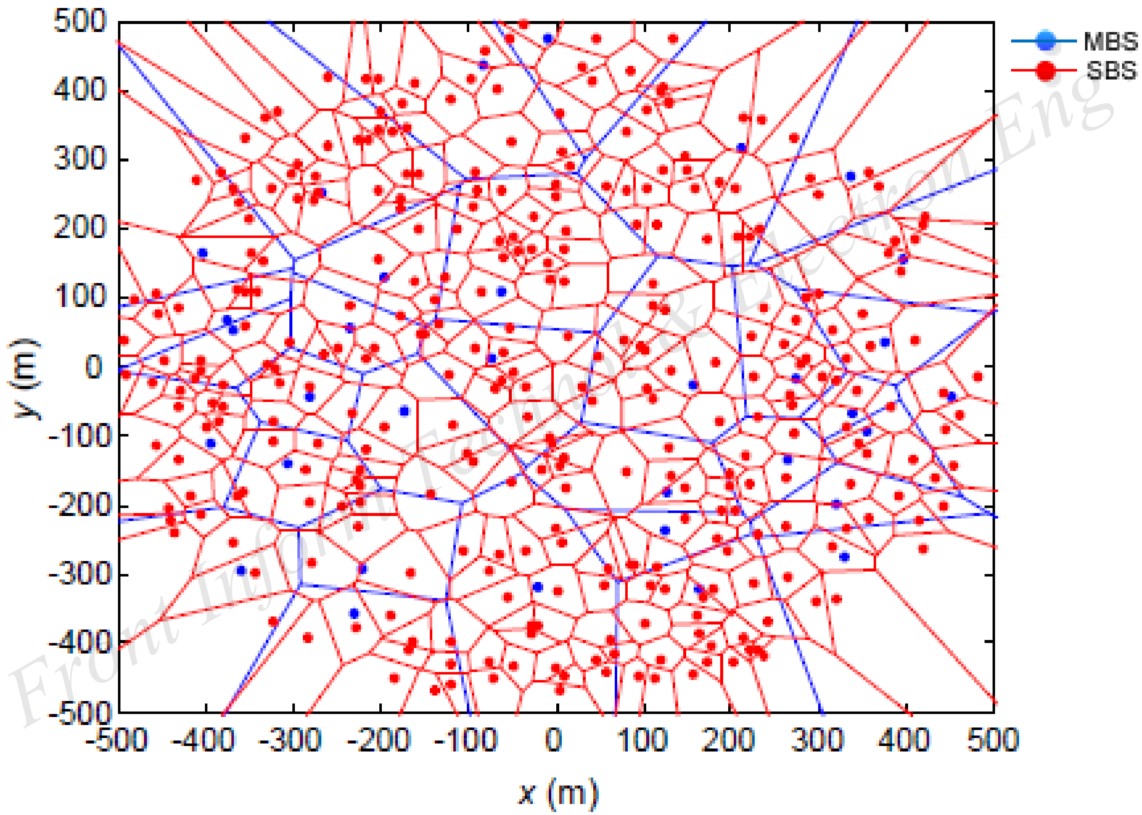


Fig. 4 Two-tier heterogeneous network (λ_M=0.00004 m^{-2}, λ_F=0.0008 m^{-2}, R=500 m)

Capacity comparison of the proposed method

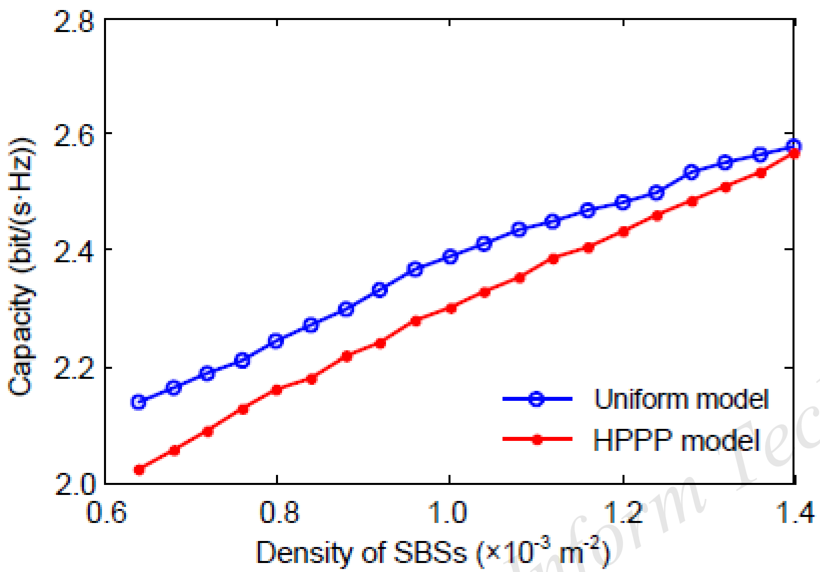


Fig. 5 Capacity comparison between the uniform model and HPPP model by integral method (λ_M=0.00004 m^{-2}, λ_F=0.0008 m^{-2}, R=500 m)

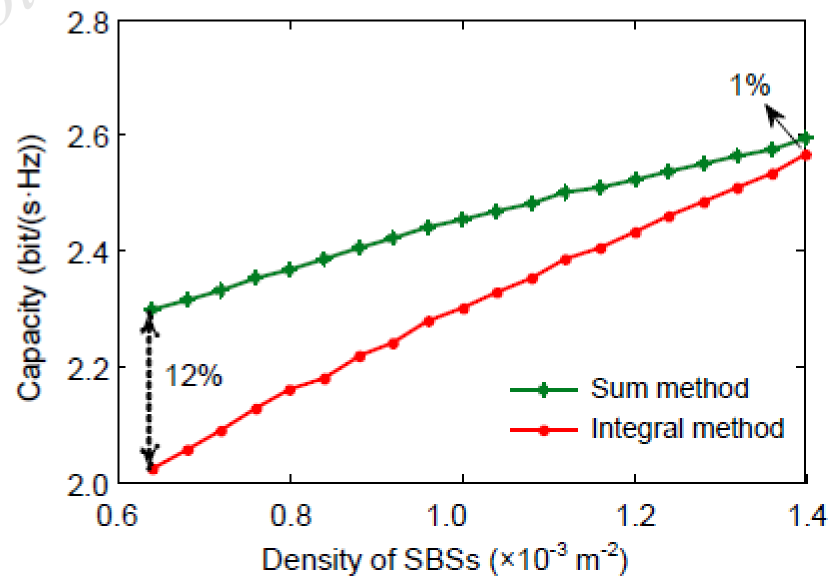


Fig. 6 Comparison between integral method and sum method in HPPP model (λ_M=0.00004 m^{-2}, λ_F=0.0008 m^{-2}, R=500 m)

Effect of the number of MBS users

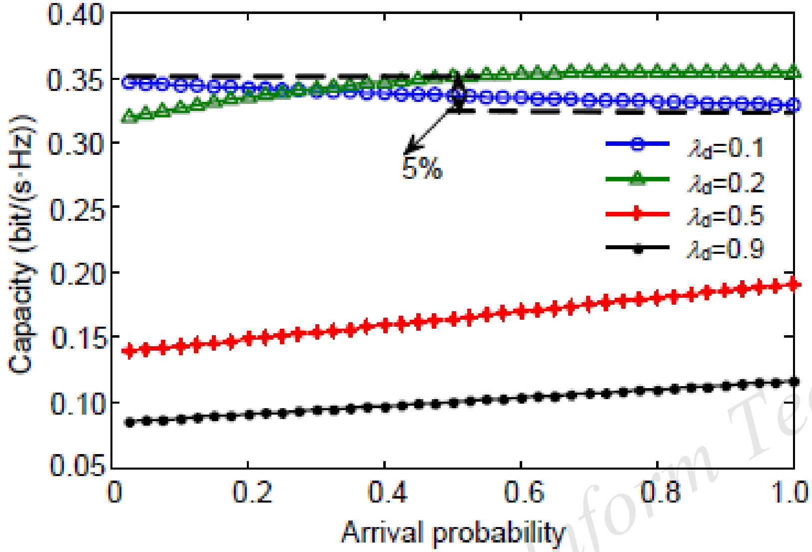


Fig. 7 Capacities under different arrival probabilities (p_{md}=0.01, p_{fa}=0.73)

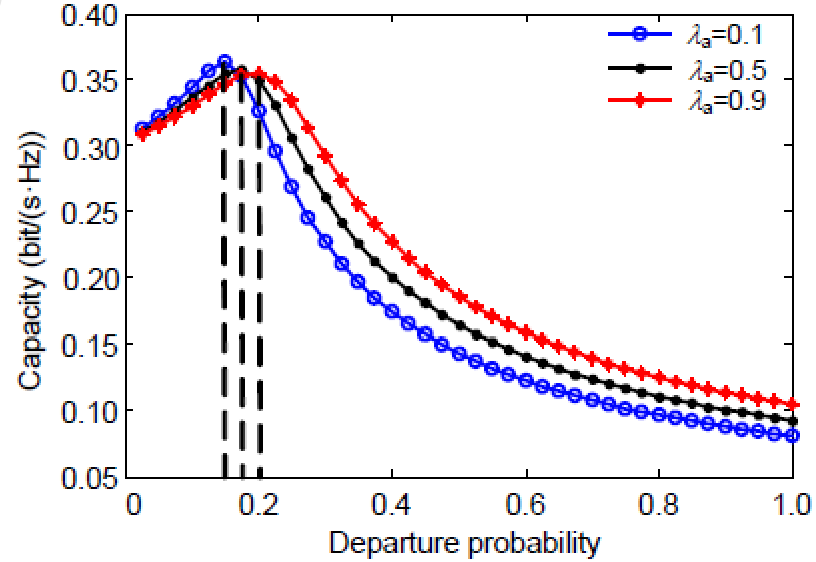


Fig. 8 Capacities under different departure probabilities (p_{md}=0.01, p_{fa}=0.73)

Effect of sensing errors

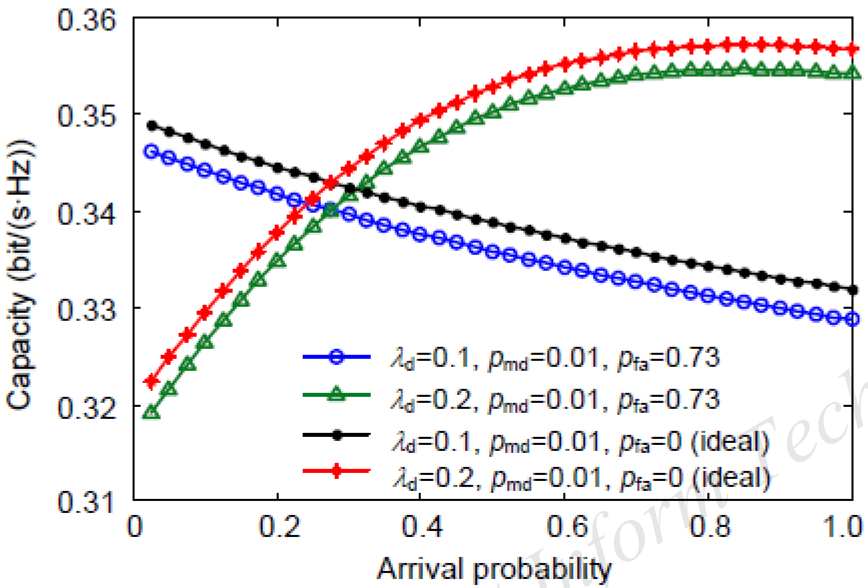


Fig. 11 Capacities under different arrival probabilities for ideal and non-ideal cases

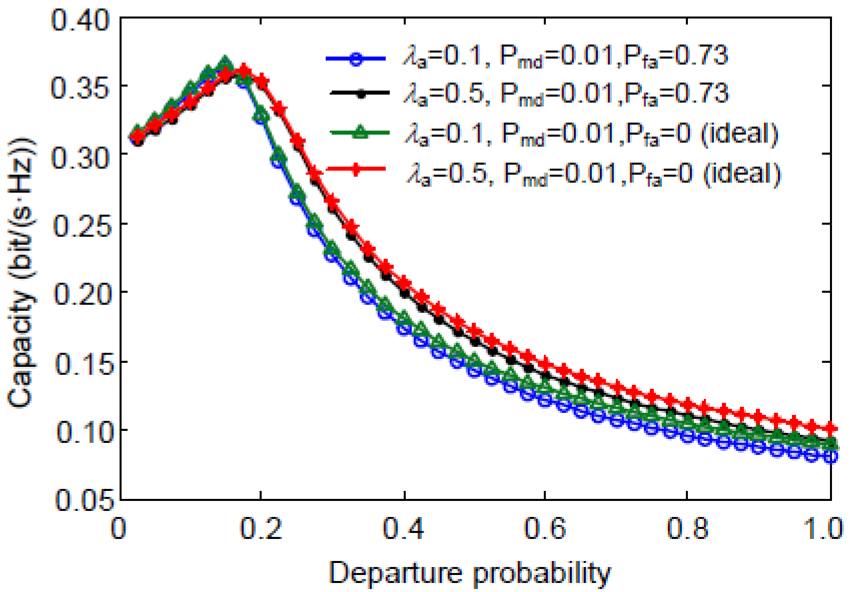


Fig. 12 Capacities under different departure probabilities for ideal and non-ideal cases

Conclusions

- Based on the HPPP network model, the proposed method turns out to be a simple and efficient way to calculate capacity in CHNs.
- When analyzing the effect of arrival and departure probability on the CHNs capacity, it has been shown that there is an optimal DP for each AP.
- Comparison has been made between the capacity of ideal and non-ideal cases, and the results verify that the non-ideal case has a higher capacity.