Decentralized Spectral Resource Allocation for OFDMA Downlink of Femto Networks Using Filled Function Method

Lamia Benmeshbah[1], Bingo Wing-Kuen Ling[2], Vikram Chandrasekhar[3], Xiaoli Chu[1] and Mischa Dohler[4]
[1]King's College London, [2]University of Lincoln, [3]University of Texas at Austin and [4]Parc Mediterrani de la Tecnologia
Lamia.benmeshbah@kcl.ac.uk, wling@lincoln.ac.uk, cvikram@mail.utexas.edu, xiaoli.chu@kcl.ac.uk and mischa.dohler@cttc.es

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Abstract

- For an orthogonal frequency division multiple access (OFDMA) downlink of a femtocell network, the aim of a resource allocation scheme is to maximise the Area Spectral Efficiency (ASE) subject to constraints on the radio resources per transmission interval accessible by each femtocell.
- In this work, the filled function method is employed to find the global maximum of such an optimization problem.
- Simulation results show that our proposed method is efficient and effective.

Problem Statement

- The size of each RB subset per transmission interval is determined based on optimizing the throughput per cell & ASE [3]
- To optimize such a decentralized resource allocation leads to a nonconvex optimization problem.

Problem Formulation

- For a given RB, denote the received SIR of a femto UE as:

$$\mathrm{SIR}_F = \frac{\Theta_0 H_0 r_F^{-\alpha_F}}{\sum_{i\in\Phi} \Theta_{0i}\,\phi^2 H_{0i} \left|X_{Fi}\right|^{-\alpha_{FF}}}$$

- The ASE offered by femtocells is given by:

$$\mathrm{ASE}_F(\rho_F) = \rho_F \lambda_F \,\mathrm{E}_{\psi_0}\left[\sum_{l=1}^{L} l \exp\left(-\rho_F k_f \Gamma_l^{\delta_f} \psi_0^{-\delta_f}\right) - \sum_{l=1}^{L-1} l \exp\left(-\rho_F k_f \Gamma_{l+1}^{\delta_f} \psi_0^{-\delta_f}\right)\right]$$

- The optimization problem is formulated as the following:

$$\max_{\rho_F} \quad \mathrm{ASE}_F(\rho_F)$$

subject to $0 < \rho_F \le 1$

Conclusions

- As the proposed method only evaluates the stationary points of the cost function, the computational effort for solving the globally optimal solution of the optimization problem is significantly reduced.

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Introduction

- A large number of femtocell access points (FAPs) are overlaid on macrocells.
- A pertinent challenge is the management of interference between neighbouring femtocells. The interference avoidance strategies [1] are preferred.
- Closed access femtocells are considered and OFDMA radio resources are partitioned into resource blocks (RBs) [2].
- The spectrum allocation policy in [3] avoids cross-tier interference by assigning orthogonal spectrum resources to the macrocell and femtocell tiers.
- It diminishes femto-to-femto interference by allowing each femtocell to access only a random subset of the spectrum resources that are assigned to the femtocell tier.

Solution Proposed

- The filled function method [4] is employed for solving the global minimum of the optimization problem.
- The proposed method only needs to evaluate the stationary points of the cost function.

Results and Discussions

- Using the filled function based algorithm, we obtain the same set of optimal values of as those obtained in [3].
- It takes only one iteration for our proposed method to reach the globally optimal solution for the considered values of number of FAP.
- Our proposed method is more efficient than the one discussed in [3].

The average number of FAPs per macrocell	ρ_F
10	1
50	0.55
100	0.3

Table 1- Simulations results

References.

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