Homework No. 2

Simulation of Unconstrained OPC Algorithm

In this homework, the OPC algorithm is applied to a simple single-cell and a two-cell wireless network. The following parameters are fixed for both cases :

- Cell coverage area = $100\text{m} \times 100\text{m}$
- Background noise power σ^2= 10^{-10}W
- OPC constant $\eta_i = 0.05$
- Path gain h_i = $0.1\ d^{-3}$

I. Single-cell Wireless Network

Simulate the system under the above conditions, for 5 number of users. The users should be uniformly distributed in the cell.

- Plot SINR and power of each user versus the number of iterations (a measure of time).
- Change the initial transmit power of users. Does it make change the equilibrium transmit power vector?
- Which users transmit at high power levels? Why? Does it depend on initial transmit power vector?
- Increase the OPC constant (η_i) from 0.05 to 1 by step size 0.01. Plot achieved sum rate versus different values of η_i. Analyze OPC constant's impact on performance of the OPC algorithm.
- Decrease the OPC constant (η_i) from 0.05 to 0.01 by step size 0.01. Plot achieved sum rate versus different values of η_i. Analyze OPC constant's impact on performance of the OPC algorithm.
- In addition to OPC constant, how other simulation parameters (such as cell size, path gains, number of users, etc.) affect on performance of OPC algorithm? Explain.

II. Two-cell Wireless Network

To study how OPC works when users move, assume a two-cell wireless network with 9 users as shown in Fig. a. Suppose that users 1 to 4 and 6 to 9 are fixed, and user 5 at $t = 0$ starts moving from its starting

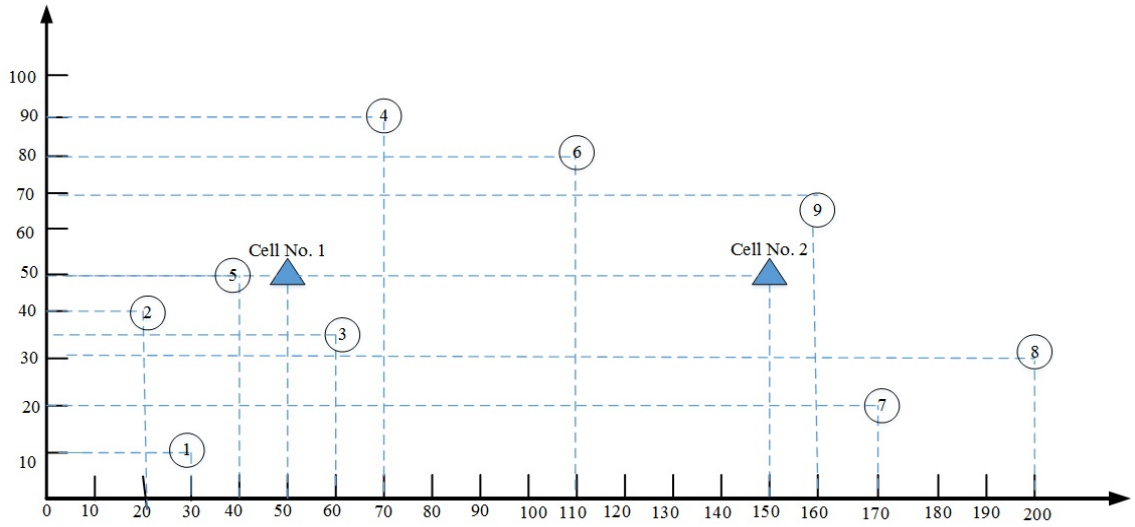

Fig. a. Distribution of users and base stations in a two-cell wireless network. Users are marked by ◯, and base stations are marked by △. Users 1 to 4 and 6 to 9 are fixed, and user 5 at $t = 0$ starts moving from the starting-point $(40, 50)$ in cell No. 1 towards the end-point $(190, 50)$ in cell No. 2 at a uniform speed of 5 m/s (18 km/h).

point in cell No. 1 towards cell No. 2 in Fig. a at a uniform speed of 5 m/s (18 km/h). The movement of user 5 from the starting point to the end point lasts 30 seconds. Each user updates its transmit power every 1 ms employing OPC. When user 5 enters cell No. 2, i.e. at $t = 13$ s, base-station 2 is assigned to it. Excluding the moving user 5, note that user 3 in cell No. 1, and user 9 in cell No. 2 are the closest users to the base station in their corresponding cells.

- Plot the transmit power levels and the received SINRs versus time for users 3, 5, and 9.
- Does movement of user 5 change the best user on each cell? How? Explain.
- Discuss and interpret the results.