Ain Shams University
Faculty of Engineering
Electronics and Communications Department
Senior-1
Spring 2025

ECE353 – Wireless Communication Networks

Project

(A) It is required to design using MATLAB/Python, a simple planning tool for a service provider that owns 340 channels in the 900 MHz band. Your code should ask for the GOS, city area, user density, SIR_{min}, and sectorization method. Assume blocked calls are cleared in this system. Then, it should produce the following design parameters:

1) Cluster Size.
2) Total number of cells in city.
3) Cell radius.
4) Traffic intensity per cell and traffic intensity per sector.
5) Base station transmitted power.
6) A plot for the MS received power in dBm versus its distance from the BS.

In your design, Use Hata model (as outdoor propagation channel model) while assuming urban-medium city. Let, the traffic per user equals 0.025 Erlang, the effective heights of BS and MS equal 20 and 1.5 meters respectively, and MS sensitivity equals $-95\ dB$, and the path loss exponent equals 4.

Note: You can find Erlang B table in the second attachment.

(B) To validate your planning tool and understand the trade-offs between different design parameters it is required to deliver for a city of area equals $100\ km^2$ the following figures with reasonable comments. Each figure should contain three curves for omni-directional, 120° sectorization and 60° sectorization designs.

1) A plot for the cluster size versus $SIR_{min}(1dB\ to\ 30\ dB)$.

2) At SIR_{min}=$19dB$ and user density = 1400 users/km^2.
   (i) A plot for the number of cells versus GOS (1% to 30%).
   (ii) A plot for the traffic intensity per cell versus GOS (1% to 30%).

3) At SIR_{min}=$14dB$ & user density = 1400 users/km^2.
   (i) A plot for the number of cells versus GOS (1% to 30%).
   (ii) A plot for the traffic intensity per cell versus GOS (1% to 30%).

4) At SIR_{min} = 14dB & GOS = 2%
   (i) Plot the number of cells versus user density (100 to 2000 users/km^2).
   (ii) Plot the cell radius versus user density (100 to 2000 users/km^2).

5) At SIR_{min} = 19dB & GOS = 2%
   (i) Plot the number of cells versus user density (100 to 2000 users/km^2).
   (ii) Plot the cell radius versus user density (100 to 2000 users/km^2).

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Note:

- You need to illustrate the design criteria you selected to use and the parameter/parameters you selected to optimize in your design. You can assume any missing parameters (**if only needed**).
- Your code should be generic to be used for different given input values as described in part (**A**).

Deliverables:

Please submit a *soft-copy* of the following items:

- All MATLAB/Python codes that produce (**A**) and (**B**).
- A short report explaining the procedure you used along with the mathematical equations. The report should also include all the figures generated by your code and your comments on each figure.

Project rules:

- Group project (4-5 students/group).
- No late reports are accepted.
- If 2 reports or codes are similar, both will have zero marks.
- If a project is copied from Internet. It will have zero mark.
- Project discussion method "To be determined later"
- Delivery method "On LMS" as separate files not compressed files.
- Project report must contain the names and IDs of all group members
- Only one member in the group must submit his/her project on LMS.

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