# Fractional Frequency Reuse Wireless Design Function

Fractional frequency reuse is a wireless frequency reuse technology that aims to increase the number of subscribers in a mobile network. The technology divides each cell into two zones as show below where given part of the bandwidth is used in the inner circle and part of the bandwidth is used in the outer circle. The size of the inner circles is defined by the power transmitted from the base station $P_{tx}^{(i)}$ on the frequency band assigned to the inner circle.
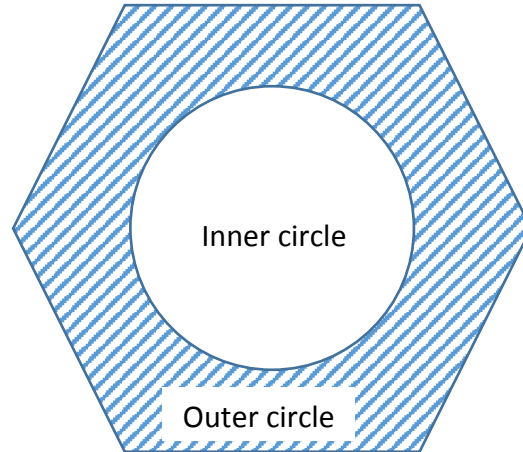
The size of the outer circles is defined by the power transmitted from the base station $P_{tx}^{(o)}$ on the frequency band assigned to the outer circle. Using this approach different reuse patterns can be used for the inner and outer circles such as the example shown below
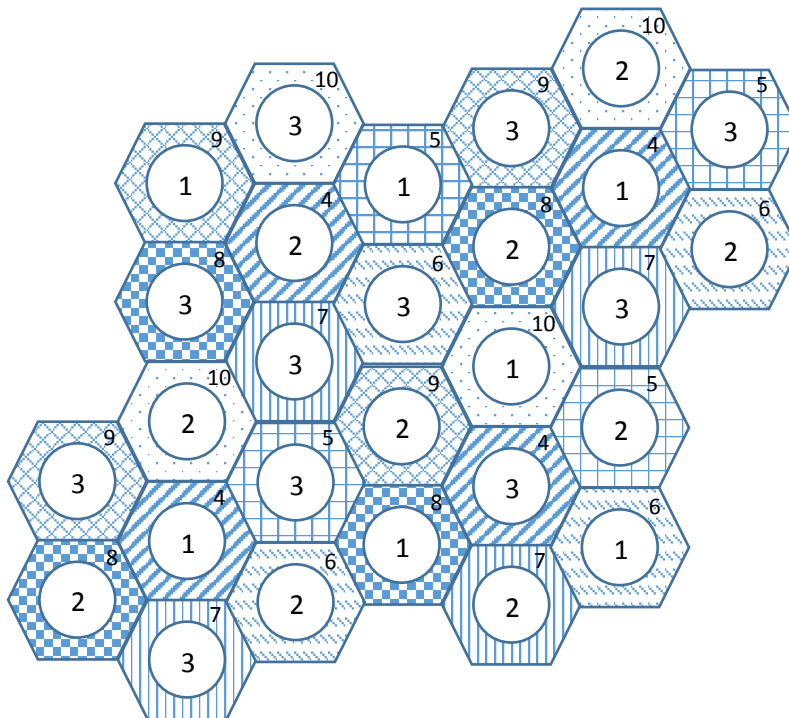
- In the example above the set of inner circles are assigned a set of channels and the set of outer circles are a assigned a set of channel.
- The number of channels assigned to the inner circles are not necessarily equal to the number of channels assigned to the outer circles.

- In the upper example the inner circles use a frequency reuse of 3 while the outer circles use frequency reuse of 7

The project Requirement

In this project it is required to build a Matlab function that can estimate calculate the smallest number of wireless cells that can cover a given area with a given subscribers density using this fractional reuse technology

The inputs to this function will be as follows

1- Sensitivity of the user.
2- The required Carrier to Interference ration
3- The area to be covered in square meter
4- The maximum power that can be transmitted from a given wireless cell (on inner and outer circles)
5- The number of channels allocated to this wireless network
6- The Erlang per user

The output of this function should provide

1- The number of wireless cells to be used.
2- The diameter of the inner outer circles.
3- The diameter of the outer circles.
4- The number of channels assigned to the outer circles.
5- The reuse factor used for the outer circles.
6- The reuse factor used for the inner circles.

Project Guide lines

1. Each group can have a maximum of 3 team members
2. The project code should be submitted using Github
3. The code should be well document and easy to understand
4. There will a project evaluation on time that will be defined later

Implementation Hints

1. Develop a function that calculates the maximum carrier to interference ration seen by a user at the edge of the inner circle and use it to find the diameter of the inner circle for a given inner circles reuse factor
2. Develop a function that calculates the maximum carrier to interference ration seen by a user at the edge of the outer circle and use it to find the diameter of the outer circle for a given outer circles reuse factor.
   Develop a function that ensures that the number of channels allocated to the outer circles are proportional to the number of users in the outer circles and that the number of channels allocated to the inner circle are proportional to the number of user in the inner circle.
3. Build a function that would loop on different options to calculate the network design that would need the least number of cells