Co-channel interference and SIR

Thursday, November 12, 2009
1:45 PM

Lecture 5

Interference

We will focus on Co-channel interference

Received Power at mobile phone @ distance d from transmitter

$$P_r \propto \frac{1}{d^\gamma}$$

This means proportional to

2 - 4

$$\propto \frac{P_t}{d^\gamma}$$

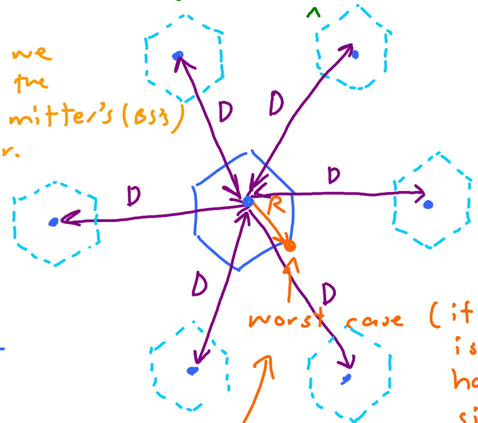
now we add the transmitter's (BS's) power.

$$= \beta \frac{P_t}{d^\gamma}$$

constant

first-tier

There are 6 ^ cochannels



worst case (if mobile phone is here, then have the worst signal strength from base station.)

$$P_i = \frac{P_t}{D^\gamma} \times \beta$$

$$P_s = \frac{P_t}{R^\gamma} \times \beta$$

SIR

(Signal to interference ratio)

$$① = \frac{P_s}{\sum P_i} = \frac{\cancel{P_t}/R^\gamma \times \cancel{\beta}}{6 \times \frac{\cancel{P_t}}{D^\gamma} \times \cancel{\beta}}$$

$$= \frac{\frac{1}{R^\gamma}}{6\frac{1}{D^\gamma}} = \boxed{\frac{\left(\frac{D}{R}\right)^\gamma}{6}}$$

← This is a very rough approximation formular of the SIR

another approximation

$$② = \frac{P_t/R^\gamma \times \beta}{2 \times \frac{P_t}{D^\gamma}\beta + 2 \times \frac{P_t}{(D+R)^\gamma}\beta + 2\frac{P_t}{(D-R)^\gamma}\beta}$$

$$= \frac{\frac{1}{R^\gamma}}{2 \quad + 2 \quad\quad 2}$$

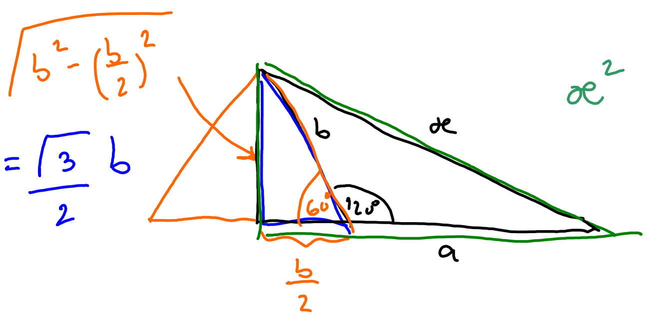
← This gives a better

$$= \boxed{\dfrac{\frac{1}{R^\gamma}}{\frac{2}{D^\gamma} + \frac{2}{(D+R)^\gamma} + \frac{2}{(D-R)^\gamma}}}$$

← This gives a better approximation of the SIR

In approximation (1), we see that $\frac{D}{R}$ is an important quantity.

We will use the geometry of hexagon to reexpress $\frac{D}{R}$ in terms of the cluster size.



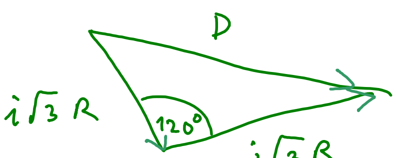
$$x^2 = \left(\frac{\sqrt{3}}{2} b\right)^2 + \left(a+\frac{b}{2}\right)^2$$

$$= \frac{3}{4} b^2 + a^2 + ab + \frac{b^2}{4}$$

$$= a^2 + ab + b^2$$

$a = j\sqrt{3} R$, $b = i\sqrt{3} R$

So, for the cochannel distance



$$D = R\sqrt{3(i^2+j^2+ij)} = R\sqrt{3N}$$

$$\boxed{\frac{D}{R} = \sqrt{3N}}$$