Validating wireless system Design via MATLAB Simulations

EWCN Laboratory
Session 4

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Experiment 4.1: Implementation of Decode and forward (DF) relaying with direct link in MATLAB

- Consider a two hop communication network where a source node S wishes to send its information to a destination terminal D via a DF relay terminal R and also the direct link ($S \rightarrow D$).
- The channel coefficients are assumed to be Rayleigh distributed and hence the channel gains will be exponential distributed.
- In the first phase, the received SNR at R and D is given by $\frac{P_s}{N_o}|h_{sr}|^2$ and $\frac{P_s}{N_o}|h_{sd}|^2$ respectively.
- During the second phase relay decodes and transmits the information and the corresponding end-to-end SNR at D is given by $\frac{P_s}{N_o}|h_{sd}|^2 + \min(\frac{P_s}{N_o}|h_{sr}|^2, \frac{P_R}{N_o}|h_{rd}|^2)$.
- Outage probability is defined as the probability that the end-to-end SNR is below a given predefined threshold.

- For the above system model, plot the outage behaviour vs transmit SNR curve and the capacity vs transmit SNR curves.
- Compare the outage behaviour of the simulated system with the outage behaviour of the system simulated in the previous lab (without direct link).
- Variance Ω_{ij} is defined as

$$\Omega_{ij} = d_{ij}^{-\alpha} \tag{1}$$

where, d_{ij} is the distance between nodes i and j, and α is the path loss exponent.

- Plot and analyze the impact of relay location on the system outage behaviour. Assume S to be at origin (0,0), R at (x,0) and D at (1,0).

Experiment 4.2: Implementation of variable gain Amplify and forward (AF) relaying with direct link in MATLAB

- For the above system considered in the previous consider the presence of direct $S \rightarrow D$ channel and analyze the system outage behaviour with AF relay.
- Plot the outage performance, capacity, relay location curves.