

**INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, ALLAHABAD**  
**ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT**

**COURSE NAME: EWCN LABORATORY**

**Experiment 1.1:** Consider a system where a source node  $S$  communicates with a destination node  $D$  over a wireless channel as shown below. For the given system, assuming nodes with single antenna and half-duplex operation, under Rayleigh fading, plot the outage versus signal-to-noise ratio (SNR) performance.

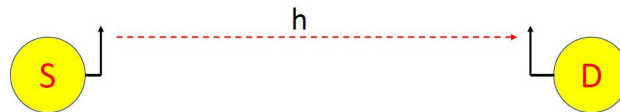


Fig. 1. Considered System Model

**Objective:** To simulate a basic wireless communication network scenario in MATLAB and to evaluate its outage performance.

**Materials/ Component Required:** MATLAB Software

**Procedure:** Follow the below mentioned steps:

- 1) Generate an exponentially distributed random variable ( $|h|^2$ ) of a given mean value.
- 2) Obtain the Instantaneous SNR.
- 3) Check if  $C_{SD} < R$ , then counter  $c \rightarrow c + 1$ .
- 4) Repeat Steps 1, 2, and 3 for a given number of trials for a  $\rho$ .
- 5) For a given  $\rho$ , after finishing up with the trials we have  $P_{out} = \frac{c}{\text{number of trials}}$
- 6) Repeat the above steps 1-5 to obtain the outage values for different  $\rho$ .

**Results:** Plot the system outage versus signal-to-noise ratio (SNR) performance.

**Experiment 1.2:** Consider a scenario, where a source node  $S$  communicates with a destination node  $D$  over the wireless channel. With single antenna and half duplex operation under the Rayleigh fading, plot the Ergodic capacity versus the transmit SNR plot.

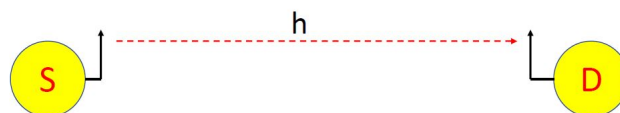


Fig. 2. Considered System Model

**Objective:** To evaluate the ergodic capacity performance of a wireless communication network scenario in MATLAB.

**Materials/ Component Required:** MATLAB Software

**Procedure:** Follow the below mentioned steps:

- 1) Generate an exponentially distributed random variable ( $|h|^2$ ) of a given mean value.
- 2) Obtain the Instantaneous SNR.
- 3) Do  $k = C_{SD} + k$ .
- 4) Repeat Steps 1, 2, and 3 for a given number of trails for a  $\rho$ .
- 5) For a given  $\rho$ , after finishing up with the trials we have Capacity =  $\frac{k}{\text{number of trials}}$
- 6) Repeat the above steps 1-5 to obtain the capacity values for different  $\rho$ .

**Results:** Plot the system capacity versus signal-to-noise ratio (SNR) performance.

**Experiment 1.3:** Consider a scenario, where  $N$  number of source node  $S_i$  are there which communicate with a destination node D over the wireless channel.. Amongst these source nodes, the node with best channel to the destination is selected at a time to communicate. With single antenna and half duplex operation under the Rayleigh fading, plot the system outage performance versus the transmit SNR plot. Also, plot the ergodic capacity versus SNR plot. Assume  $N > 3$  for analysis. What is the diversity achieved here?

**Objective:** To evaluate the outage and ergodic capacity performance of a wireless communication network scenario with multiple number of source nodes in MATLAB.

**Materials/ Component Required:** MATLAB Software

**Procedure:**With the multiple source nodes, follow the steps mentioned for Exp 1.1 and 1.2.

**Results:** Plot the system capacity versus signal-to-noise ratio (SNR) and outage versus SNR performance for the multiple source node communicating with a single antenna.

**Experiment 1.4:**Consider a scenario, where a source node  $S$  with a single antenna communicates with a destination node D with  $L$  antennas over the wireless channel. At D, the contributions at all the antenna terminals are added. With half duplex operation under the Rayleigh fading, plot the system outage performance versus the transmit SNR plot. Also, plot the ergodic capacity versus SNR plot. Assume  $L > 3$  for analysis. What is the diversity achieved here?

**Objective:** To evaluate the outage and ergodic capacity performance of a wireless communication network scenario where the destination terminal is equipped with multiple antennas in MATLAB.

**Materials/ Component Required:** MATLAB Software

**Procedure:** With multi-antennas at destination nodes, follow the steps mentioned for Exp 1.1 and 1.2.

**Results:** Plot the system capacity versus signal-to-noise ratio (SNR) and outage versus SNR performance where the destination terminal is equipped with multiple antennas.