EE455– Mobile Communication

Homework 1- Ergodic capacity

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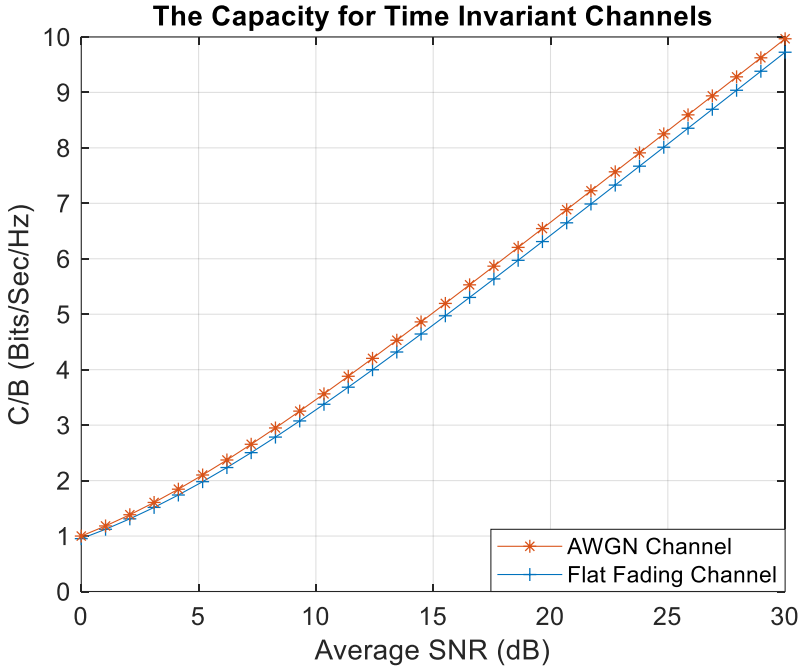
Draw the capacity for the time-invariant flat fading channel and AWGN channel.



In that figure, comparison of the capacity for AWGN Channel and Flat Fading Channel can be seen. According to the figure, it can be said that the capacity of the AWGN channel is larger than that of the fading channel for all average SNR values between 0 and 30dB. On the other hand, the capacities of the AWGN and fading channel with transmitter and receiver CSI are very closer at low SNR values. Also, although it cannot be observed according to this figure when the SNR value is less than 0, the capacity of the fading channel is larger than the AWGN channel capacity. Since AWGN channel limiting its own capacity because of having always same low SNR. Also, there is no limit for the distribution range of a fading channel's SNR that's why that channel type will occasionally have a high SNR with the same average SNR.

Flat Fading Capacity ➔ $C = \sum_0^\infty B \log_2(1+\gamma)p(\gamma)d\gamma$

AWGN Capacity ➔ $B \log_2(1+\gamma)$

In the codework, firstly SNR array is set between 0 and 30. Then, it transformed decibel to linear factor. After that, a set of SNRs is created, the size of which is up to block size and the average of which is equal to the desired average SNR. The 'raylrnd' function is used for this operation. The value is used for the function is 0.7985 which equals $\frac{1}{\sqrt{2}}$. Since the block size value is 10^5 and they should all have equal probability, The probability of the specified snr value is set to $1/10^5$. Then, Flat Fading Capacity was calculated in the first while cycle and AWGN capacity was calculated in the other while cycle using the formulas mentioned above.