



ENHANCEMENT OF CHANNEL CAPACITY WITH THE HELP OF WATERFILL APPROACH

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Abstract

Besides, to get an excellent Throughput improvement, we proceed onward to SC-FDMA with ICI estimation and ICI concealment strategy, it has the capability of lessening the PAPR of the OFDM signal without influencing the bandwidth proficiency of the system. All previously mentioned techniques have been incorporated to streamline the PAPR reduction and Throughput improvement in OFDM and MIMO-OFDM system. In the proposed work, channel limit, ergodic limit and blackout limit have been examined by execution of Waterfill approach with mix of SVD approach. Channel limit acquired through proposed approach was contrasted and unique limit of framework got with proposed approach. This presumes channel limit is improved by utilizing proposed approach with various number of antenna component blends.

Keywords: Channel, Capacity, Waterfill

1. INTRODUCTION

Before the invention by Shannon, it was assumed that reducing of data rate is the only way to get the reliable communication in the presence of noisy channel. Claude Shannon invented the concept of information theory in 1948. The purpose of invention was to characterize the various limits of reliable communication. With the invention of Claude Shannon, this assumption was proved as false. He showed that, with the concept of maximal rate, known as channel capacity, this can be done: if anyone transmits data with the higher rate than channel capacity, then process to make the error probability equals to zero is impossible. Here, the focus is on the AWGN channel:

$X(m)$ =real input at time m

$Y(m)$ =real output at time m

$W(m)$ =noise independent over time.

$=N(0, \sigma^2)$ It can be written as

$$Y(m) = x(m) + w(m)$$

The capacity of any channel can be defined as the data rate at which reliable communication take place.

Consider P =power constraint

σ^2 =noise variance

Then capacity of AWGN channel can be written as

$$C_{awgn} = \frac{1}{2} \log \left(1 + \frac{P}{\sigma^2} \right)$$



2. WATERFILL APPROACH:

If the specifications about the sender and that of the receiver are known then the capacity of framework can be enhanced with the help of some algorithm. Water filling approach based on iteration process with SVD method is an effective way for this task. In Water filling strategy force for spatial channels are balanced taking into account channels pick up. Channel which has high signal to noise proportion and gain up is allocated higher energy. This higher energy boosts up rate of information in whole small channels in the framework. The rate of information of every Part of channel can be expressed in terms of capacity defined by a great scientist named Claude Shannon as written below:

$$Capacity = \sum_{i=1}^n \log_2 (1 + Power\ Allocated * H)$$

The combination of transmitting antenna and receiving antenna used is shown in table 1 below.

Table 1: Combination of Transmitting and Receiving Antenna

S. No.	No. of Transmitting Antenna	No. of Receiving Ant
1	1	1
2	2	2
3	2	3
4	3	2
5	3	3
6	4	4

This approach is equivalent to the process of putting the water in any type of vessel. The clear part in Figure shows energy gain of any link. The colored Part is that part which has because of allotted energy. Represents range of level of water

3. PROPOSED ALGORITHM

$$C = B \log(1 + SNR)$$

Procedure of water-filling is like pouring water in vessel. Un-shaded segment of diagram speaks to converse of power addition of a specific channel. Part speaking to shadow speaks to Power distributed or water. Demonstrate most extreme water level. Aggregate sum of energy dispensed is relative Signal to clamor proportion of channel.

Framework capacity would be equivalent to arithmetical aggregate of limits of all channels scientifically it can be composed as:

1) From measured gain of channel of framework, find its inverse value. It can be represented by ICG.

$$ICG = \sum_{i=1}^n \frac{1}{H_i}$$



2) Due to the result obtained in step 1, this approach has step structure in the non-uniform type.

3) Now obtain the result by adding ICG and framework power P_t .

$$P_t + I_{CG}$$

4) Calculate mean of power allotted as given in equation

$$\frac{P_t + I_{CG}}{\sum \text{framework channels}}$$

5) After this find the range of power allotted to every sub channel available in the framework. This can be calculated as

$$\frac{P_t + I_{CG}}{\sum \text{framework channels}} - \frac{1}{H_i}$$

6) Procedure of iteration will be continued until the value of PAP becomes negative.

- **Concept of Outage Probability:**

Mathematically it can be written as

$$PB_{outage} = P_t(\log \det (I_{Nr} + hvh^+) < I_{Rt})$$

In the above equation

V=covariance

h= channel matrix

IRt =rate of information

- **Ergodic capacity:**

Mathematically it can be written as

$$E_{cap} = E \left\{ \log_2 \left(1 + \frac{P_t}{\delta^2} |L^2| \right) \right\}$$

In the above mentioned equation

Ecap=ergodic capacity

L=impulse response of framework channel with constant value for all set of transferred symbol.

δ = noise power of framework channel

- **SVD Approach:**

Working method of this approach at the time of operation on matrix of channel near about same as of operation in frequency domain by DFT

From analysis point of view, assume

H=matrix known as channel matrix of TxR

Assume this with condition of independency on all element of matrix. Then according to this approach, it can be written as

$$H = U_M \sum V_M^{hm}$$

In the above equation

UM =an matrix known as unitary matrix of RxR

VM=an matrix known as unitary matrix of TxT

hm = Hermittan of VM.

Σ = TxR matrix

4. SIMULATION RESULTS:

4.1 Outage Capacity in AWGN channel:

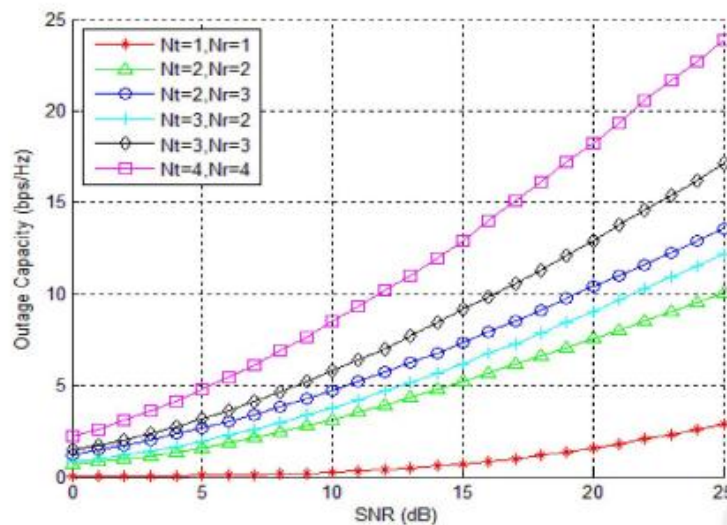


Figure 1: Outage capacity in case of AWGN channel

Figure 1 shows the graph between outage capacity and signal to noise ratio in the case of AWGN channel. From the graph it is clear that capacity of framework increases with the number of antenna element.

Figure 2 shows the graph between outage capacity and signal to noise ratio in the case of AWGN channel when the value of $P_{outage}=0.3$. From the graph it is clear that capacity of framework increases with the number of antenna element.

Figure 3 shows the graph between outage capacity and signal to noise ratio in the case of AWGN channel when the value of $P_{outage}=0.5$. From the graph it is clear that capacity of framework increases with the number of antenna element.

Figure 4 shows the graph between outage capacity and signal to noise ratio in the case of AWGN channel when the value of $P_{outage}=0.7$. From the graph it is clear that capacity of framework increases with the number of antenna element.

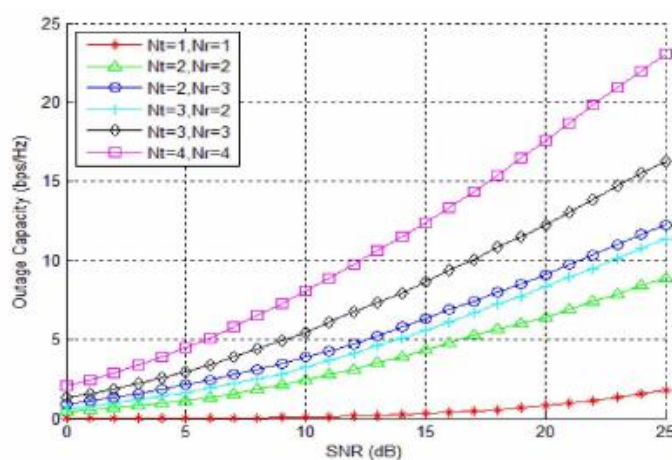


Figure 2: Outage capacity in case of AWGN with $P_{outage}=0.3$

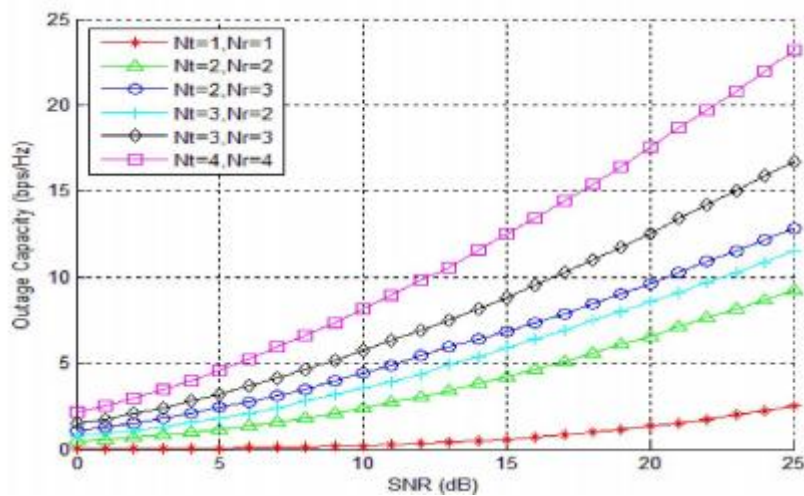


Figure 3: Outage capacity in case of AWGN with Poutage= 0.5

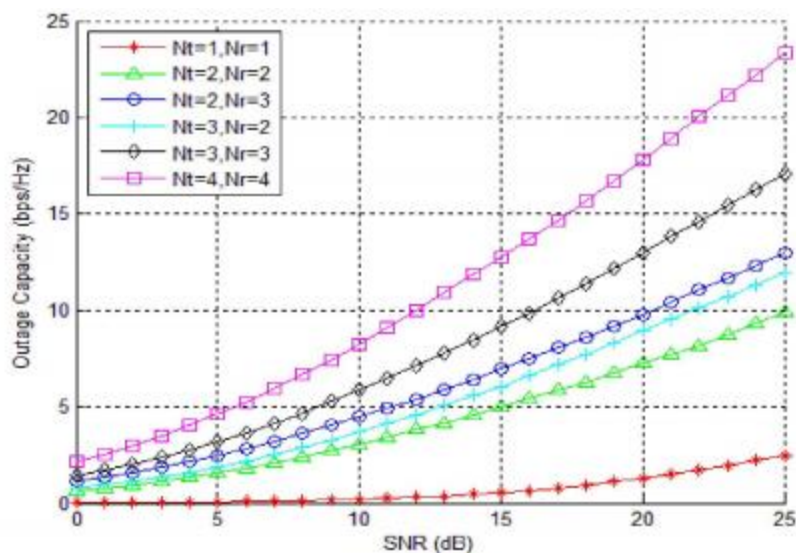


Figure 4: Outage capacity in case of AWGN with Poutage= 0.7

4. CONCLUSION

This paper has presented the results showing performance enhancement, by employing the Waterfill algorithm, measured in terms of channel capacity, outage capacity and ergodic capacity of system. Channel capacity results have been compared with and without the deployment of water fill algorithm. The results have been shown for different

numbers of antenna combinations at input and output side. For the analysis AWGN and Rayleigh Fading type channels have been assumed.

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