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ENHANCEMENT OF CHANNEL CAPACITY USING POLAR CODES FOR NAKAGAMI FADING

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ABSTRACT: In wireless communications environment probability distribution value of signal fading relative to a specified reference level has to be measured. . As the multipath effects are continuously changing, the frequency changes due to movement of objects in environment including the user when the mobile station is also moving in different directions at different speeds. Here the channel capacity is clearly an intrinsic property of the channel in which we have introduced polar codes with frozen bits as to maintain the channel capacity. In this paper we have applied polar codes for Nakagami fading channel and explained about the performance observed in the channel capacity.

1. INTRODUCTION:

In wireless communications various distributions such as Rayleigh, Ricians and Nakagami, are used to model scattered signals that reach the receiver by multiple paths. Depending on the density of scatters the signals will display different fading characteristics.

As per the empirical and practical test models Nakagami distributions exhibits better channel capacity compared to Rayleigh distributions, but gives more control over the extent of fading. As we know that every channel coding technology works in similar way, where as Communication links undergoes to errors due to random noise, interference, device impairments etc, that corrupt the original data stream at the receiver end. Channel coding contains set of algorithmic operations on the original data stream at the receiver to correct these errors. However the real challenge here is complexity that allows practical implementation.

In this paper we represents the method of construction on Nakagami fading comparing with Rayleigh fading channel[1]. It says about direct and major reflected paths between a stationary transmitter and a moving receiver. Channel polarization is an operation in which one manufactures out of N independent copies for given B-DMC W in a second set of N channels.[2]. This section gives a brief overview of fading channels and describes how to implement those using the MATLAB. Improving data transmission over wireless channels has been the main passion for many researchers since many years [3]. Then Shannon has discovered his theorem of information transmission, a lot of work has been done to attain his limit. In spite of that no one has succeeded. Polar codes were the first codes that approximate Shannon's limits of capacity, therefore, they have most of the researchers' interest to be studied in 5G systems. These systems require significant improvements in channel capacity, polar codes are excellent techniques that have the ability to offer these improvements.

As to overcome the need of desired channel capacity and algorithm complexity of Low Density Parity Check Codes (LDPC). we are placing dynamic frozen symbols along with polar codes to achieve high channel capacity and gain the induced sub channels of polarizing transformation which were modeled as multipath fading channels that are tracked at the decoding section[3].

2. SYSTEM MODEL

The Analysis and coverage of bit error rate (BER) in a Nakagami fading channel for Wireless systems is developed. Most of the analysis considers the nodes to be static and the received power followed by Gamma distribution. However, nodes in Mobile Adhoc Networks are mostly undergoes mobility, we have to be able to recover original information at the receiving part. The noise of the channel distorts the information that is transferred between the sender and the receiver and that makes the receiver not confident that it has the correct version of the information. Therefore, the idea behind channel codes or error correcting codes is basically introducing redundancy in an intelligent fashion for reducing the errors that are expected to arise due to the channel noise.

For any channel, this mismatch in design and operating SNRs translates to a change in error performance for the same rate at which the polar code was originally designed. Generally, in a fading scenario, the power constraint Q dictates the (reduced) effective rate to which symbols are transmitted. This is because, it is not possible to invert all the channels the codeword sees, for that would require an infinite amount of power. Thus it results in loss of codeword symbols at those instances when the channel is too bad to be inverted. When the channel gain is H_k, the symbol transmitted is chosen from a BPSK constellation whose power is P · Note that when $|H_k|$ is close to zero, a large amount of power is required to invert the channel.

This suggests the following strategy. When $|H_k|$ is less than a certain δ, transmit at zero power (i.e., transmit nothing). During all other instances, transmit at power P . This results in some codeword symbols getting lost, whenever the channel is bad $|H_k| < \delta$. Thus, we would like δ to be considered as small as possible.

Basic structure of communication system including BPSK modulation along with nakagami fading channel explains the transfer of bits from transmitter to receiver is shown in following figure.We also represented Random interleaver and de interleaver for accepting a set of symbols and rearranging them, without repeating any symbol in the set. Hence the number of symbols in each set is a fixed length for given interleaver. Interleaver and De interleaver functions viceversa operation. Which can be useful for reducing errors caused by burst errors in a communication systems.

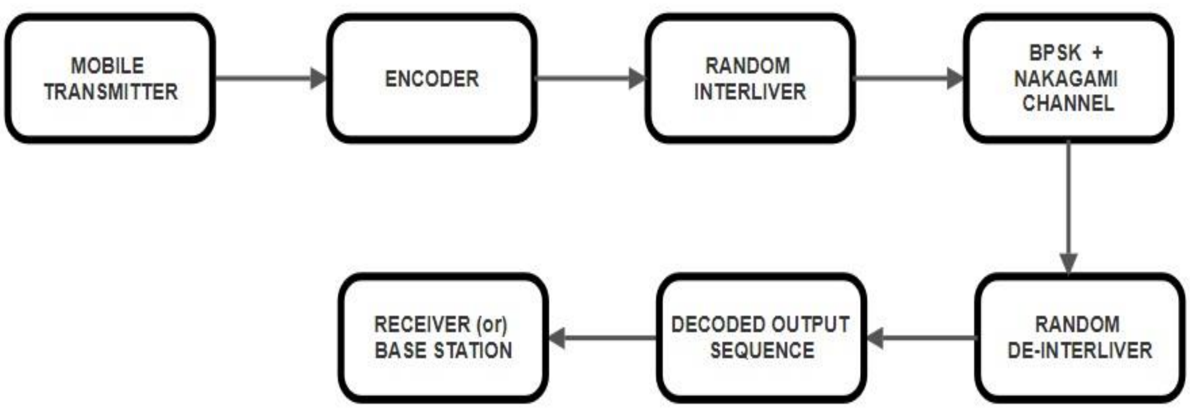

Fig 1. Basic Design flow

A very important characteristic of polar codes implies the non universality. We know that code can change significantly with different choices of design SNRs. The choice of a good design SNR is very much important. More accurate construction algorithms exist in many of channel. The best achievable performance is approximately same for any construction algorithm for at least until N≤64K.Hence the choice of good design SNR is much important than the choice of construction algorithm. The difference between design SNR gives different codes which perform differently, best one is choice based on critical observation.

The **Nakagami distribution** is relatively new fading distribution model. For a Rayleigh fading channel model, when channel state information (CSI) is available at both the transmitter (referred to as CSIT) and the receiver (CSIR),[8] discusses a polar coding technique by quantizing the fading states with usage of multiple polar codebooks. It has been used to model attenuation that accured and also signals that transversing multiple paths and the impact caused by fading channels on wireless

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communications. The Nakagami distribution is a probability distribution related to the gamma distribution. It has two parameters namely a shape parameter μ and second parameter is controlling spread ω.

The nakagami distribution having the PDF of the form.

$$\mathbf{f_{(x;u;\omega)} = \frac{2\mu^{u}}{\Gamma(n)\omega^{u}} X^{2\mu-1} e^{\frac{u}{\omega}k^{2}} \quad for\ x \geq 0}$$

---(Equation 1)

NUMERICAL RESULT

As per the simulation results, we show that receiving SNR gradually increased in proportional to decreasing the BER in support of broadcast users and longdistance transceivers.The polar coding technique provides improved channel quality for only users with the best channels are allocated system resources. Therefore, this proposed system was used to enhance in the direction of raise the reliability and capacity of Numerical results conveys that the number of indices were maintained as to lower the noise and error probability in the proposed system. The computational techniques used in this paper were used to estimate the probabilities in bit subchannels of system.

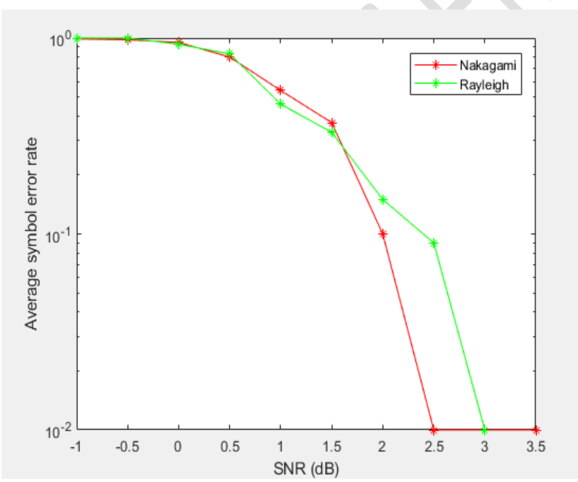

Fig 2. Performance and comparision of SNR and average symbol rate of Nakagami and Rayleigh channel using polar code.

Figure 2 shows theoretical and empirical error probabilities in bit subchannels of polarizing transformation.We have taken ratio r=1/3 and k bits length as 120 for indices length L=8. this leads for obtaining quite accurate results in all expect very bad subchannels .Under the sequential decoding with different values of list size l.hence the codes are optimized to nakagami fading channel with SNR=2.5db where as Rayleigh fading channel provides SNR=3db.

Hence it can be noticed that sufficiently large l the considered polar codes provides better gain with respect to ldpc codes which justifies the fairness of comparision.

CONCLUSION

In this proposed system, we evaluated and compared the performance of wireless communication systems employing various forms of coding by combining the outputs without diversity and with multiuser diversity through Nakagami fading channel. We can conclude that Nakagami channel gives the less BER for a given SNR using Single and Multi frame simulation techniques as compared to Rayleigh and Rician Channel. This is main factor where we can adopt mobile environment as to reduce the noise and increase the channel capacity of any mobile environment. So, Nakagami channel is the best channel for wireless communication.

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