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COMPARISON BETWEEN OUTAGE ANALYSIS OF CODED COOPERATION WITH TWO RELAYS IN RAYLEIGH FADING AND NAKAGAMI-M FADING

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ABSTRACT

In this paper we determine, the outage analysis of coded cooperation by the help of two relays, and rayleigh fading and by comparing it with the Nakagami-m Fading, with the help of different graphs. In general form of fading, we prove a solution for outage probability. Further, we find the critical coded cooperation ratio, where the outage probability is minimum.

INTRODUCTION

In this system, it does not support multiple antenna, because of size, power, complexity or other constraints. The main idea was to use resources of other nodes (such as relays) with respect from source to destination. Many other cooperative protocols and techniques were used, which is known as coded cooperation, in which channel coding is associated with cooperative signaling.

Coded cooperation is based on incremental redundancy and thus allows a more flexible distribution of channel symbols between the transmitter and relay, compared to repetition. In the coded cooperation, cooperation signaling is integrated with channel coding. Many of the previous work [1], [2] depends upon Rayleigh fading channels and also upon the instantaneous signal-to-noise ratio (SNR) for the analysis of outage behavior. The outage probability was defined in [3] in terms of instantaneous received power.

Since we have reached to the expression of outage probability for Nakagami-m fading [4] with instantaneous received power [4]. The system model of the present analysis is different to that of [4]. The outage analysis [4] was limited for different coded cooperation scenario and the expression for it was not a closed form expression.

The cooperation ratio (α), the value of it minimizes the overall outage probability. The critical cooperation ratio is described in below section i.e. section II and the expression for outage probability is in section IV. This system model is described in section II. The different graphs are shown in section V and the brief discussion of future scope of this work in section VI.

SYSTEM MODEL

System model consist of transmitter, two relay and receiver shown in fig(a). We use half duplex transmission. The transmission takes place in two phases. In first phase transmitter transmits N_1 bits of N bits, which are received by each relay and receiver. In second phase transmitter and each relay will transmit N_2 bits to receiver. We define the cooperation ratio (α) as

$$\alpha = N_1/N$$

the correctness of reception at relays will be validated on the basis of their cyclic redundancy checks (CRCs). At which relay CRC will be not validated will not take part in second phase.

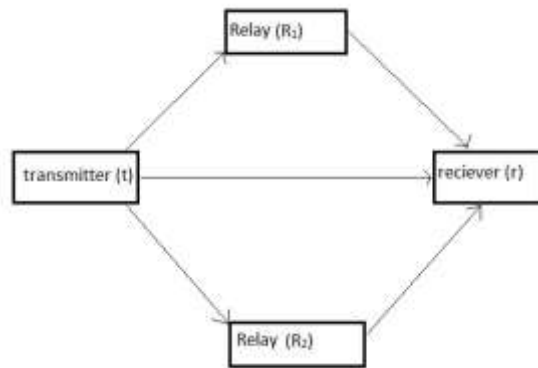


Fig (a): System Model

P_n is threshold power. Outage event can be defined as

$$P_{out} = P_r \{P < P_n\}$$

There are four distinct cases for the transmission in second phase, based on correctness of reception at relays:

Case I: CRCs of both R_1 and R_2 are validated: Instantaneous powers of both links are P_{tR1} and P_{tR2} . $P_{tR1} > P_n/\alpha$ and $P_{tR2} > P_n/\alpha$.

Case II: CRCs of both R_1 and R_2 are not validated: Instantaneous powers of both links are P_{tR1} and P_{tR2} . $P_{tR1} < P_n/\alpha$ and $P_{tR2} < P_n/\alpha$.

Case III: CRC of only R_1 is validated: Instantaneous powers of both links are P_{tR1} and P_{tR2} . $P_{tR1} > P_n/\alpha$ and $P_{tR2} < P_n/\alpha$.

Case IV: CRC of only R_2 is validated: Instantaneous power of both links are P_{tR1} and P_{tR2} . $P_{tR1} < P_n/\alpha$ and $P_{tR2} > P_n/\alpha$.

CODED COOPERATION

Coded cooperation is based on incremental redundancy and thus allow a more flexible distribution of channel symbol between the transmitter and relay compared to repetition. In the coded cooperation, signaling is integrated with channel coding.

OUTAGE ANALYSIS

For non cooperative direct transmission between transmitter and receiver. By quasi-static fading, the capacity on channel realization can be expressed by shannon formula $C(\gamma) = \log_2(1 + \gamma)$ bits per second per hertz (b/s/Hz).

The channel capacity falls below threshold rate R , outage event is $\{C(\gamma) < R\} = \{\gamma < 2^R - 1\}$

The outage probability is

$$P_{out} = P_r\{\gamma < 2^R - 1\}$$

The outage probability for Rayleigh fading

$$P_{out} = 1 - \exp(-2^R - 1/\Gamma)$$

For Nakagami-m distribution, received power (p) has a Gamma distributed p.d.f. Outage probability is

$$P_{out} = 1 - \Gamma(m, mP_n/P) / \Gamma(m)$$

$\Gamma(m)$ is Gamma function and defined as

$$\Gamma(m) = \int_0^\infty x^{m-1} \exp(-x) dx.$$

Outage events for four distinct cases are:

Case I: If $P_{r1} > P_n/\alpha$, $P_{r2} > P_n/\alpha$,

The outage event is, $\alpha P_{tr} + (1 - \alpha)[P_{r1r} + P_{r2r}] < P_n$

Case II: $P_{r1} < P_n/\alpha$, $P_{r2} < P_n/\alpha$,

The outage event is, $\alpha P_{tr} < P_n$

Case III: If $P_{r1} > P_n/\alpha$, $P_{r2} < P_n/\alpha$,

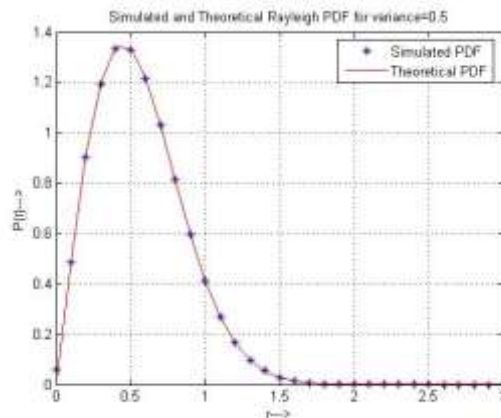
The outage event is, $\alpha P_{tr} + (1 - \alpha)[P_{r1r}] < P_n$

Case IV: If $P_{r1} < P_n/\alpha$, $P_{r2} > P_n/\alpha$

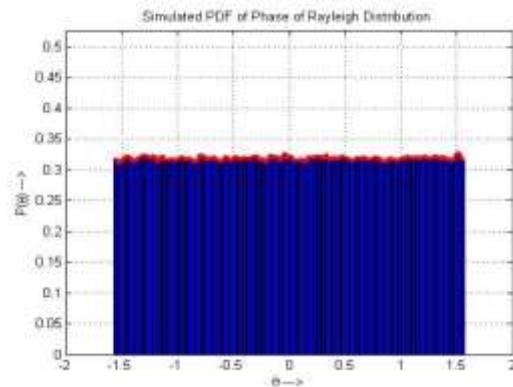
The outage event is, $\alpha P_{tr} + (1 - \alpha)[P_{r2r}] < P_n$

SIMULATION AND RESULT

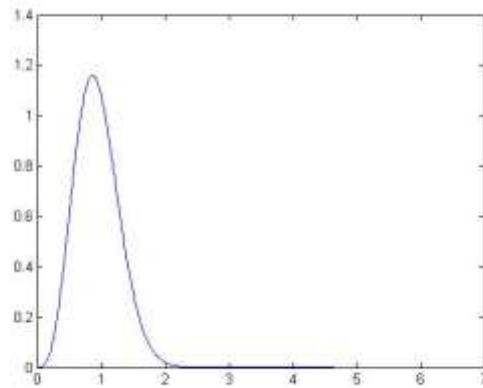
Simulation of rayleigh fading and Nakagami-m fading is done and the results has been shown in fig(1), fig(2) and fig(3).



Fig(1): Simulation of simulated and rayleigh PDF



Fig(2): Simulation of PDF of phase rayleigh distribution



Fig(3): Simulation of theoretical pdf for Nakagami- m fading

CONCLUSION

The outage probability of the Rayleigh fading and Nakagami-m fading is shown in graph. The outage probability of Rayleigh fading is more than of the outage probability of Nakagami-m fading. It shows that the Pout for Nakagami-m fading is less than that of Rayleigh fading. Nakagami-m fading is more beneficial than the Rayleigh fading.

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