Scientific Journal of Impact Factor (SJIF): 5.71
e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 03, March -2018

CLOSED FORM EXPRESSIONS FOR OUTAGE IN INTERLEAVE-DIVISION MULTIPLE ACCESS (IDMA) SYSTEM USING RAYLEIGH FADING CHANNEL

Kishan Kumar[1],Ashawani Kumar[2]

[1]*M.Tech, Department of Electronics and Communication Engineering, School of Engineering, BBDU, Lucknow, India*
[2]*M.Tech, Department of Electronics and Communication Engineering, School of Engineering, BBDU, Lucknow, India*

Abstract:- *In this letter, a closed-form outage expression is derived for interleave-division multiple access systems with decode-and forward relaying subject to multipath Nakagami-m fading channels. Then, take inverse Laplace to MGF and derived expression is used to analyze system performance for different parameters, such as number of relays and Nakagami-m fading parameter. The accuracy of theoretical derivation is extensively validated through comprehensive computer simulations. It is shown that the results obtained by the proposed expression are in well agreement with the simulation results.*

Keywords: *- Nakagami-n Fading channel, Outage probability (Pout), IDMA*

1. Introduction: Rayleigh fading is a statistical model for the effect of a propagation environment on a radio signal, such as that used by wireless device. Rayleigh fading models assume that the magnitude of a signal that has passed through a transmission medium will vary randomly.

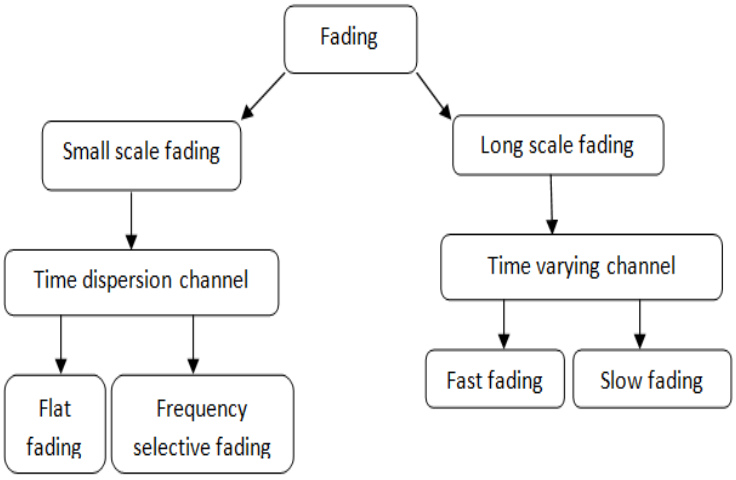

Fig.1Classification of Fading

Cooperative communication has become an effective technology for combating channel fading and greatly enhancing transmission performance of wireless systems. Consequently, cooperative communication techniques have been comprehensively studied over past decade by many researchers [12]–[14].

Two general relaying strategies for cooperative communications, decode-andforward (DF) and amplify-and-forward (AF), have been proposed [12]. An interleave-division multiple access (IDMA) system can effectivelycombat the inter-user interferenceand providegood performance to the increasing demand for high rate communications [15]–[17]. The IDMA technique has been proposed as an alternative system to existing spread spectrum strategies such as direct-sequence code-division multiple access (DS-CDMA) system which is used in today's wireless communication systems. In [18], the cooperative IDMA system with DF and AF protocol over Rayleigh fading was introduced by means of simulations. Note that the authors in [18] did not present any analytical results for their system. In [20], the authors focused on the cooperative IDMA network and proposed a relay-assisted partial packet recovery scheme. The existing studies in the literature, some of which are mentioned above, present different performance metrics for cooperative IDMA systems under different

constraints.Interleaving is a process of rearranging the order of a sequence of symbols in some unique one to one deterministic manner. This process restores the sequence to its original orders. Interleaving technique generally deployed to disperse burst errors when the received signal level fades and reduce the concentration of errors that are applied to the channel decoder for correctionInterleaving is techniques used in convert a transmission channel with memory [8].

The performance of Forward Error Correction systems operating is the presence of burst errors is improved by passing the coded signal through an interleaving process.The fundamental principle of IDMA is interleaving sequence. The network is analyzed over
multipath Nakagami-m fading channels and IDMA increase the spectral efficiency.

2. CDMA VD IDMA:-

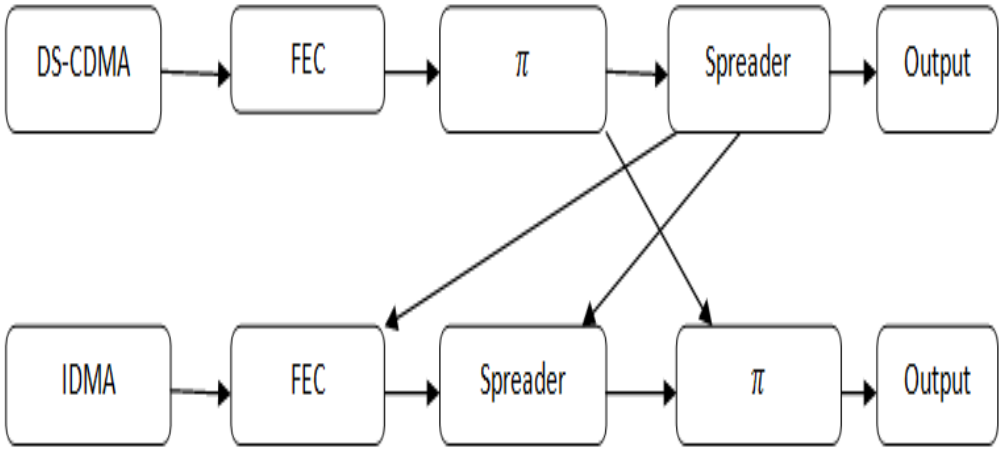

Fig.2CDMA VS IDMA

IDMA is special form of CDMA in which different interleaves are used for used for user separation. In CDMA encoding and spreading are done separately but in IDMA both operation are combined as shown in Figure 1. The main difference between CDMA and IDMA is simple as shown in which user data is interleaved and then spread in CDMA where as in IDMA the data is spread first and then it is interleaved with different interleave for different user.

3. OUTAGE ANALYSIS: The IDMA technique has been proposed as an alternative system to existing spread spectrum strategies such as direct-sequence code division multiple access, system which is used today is wireless communication. When the multipath Nakagami-*m fading channels are* assumed the PDF [3] of the instantaneous SNR is.

$$P_{\gamma ij}(\gamma) = \sum_{P=1}^{P_{ij}} \frac{\left(m_{ij}^{P}\right)^{m_{ij}^{P}}}{\left(\overline{\gamma}_{ij}^{P}\right)^{m_{ij}^{P}}} \frac{\gamma^{m_{ij}^{P}-1}}{\Gamma\left(m_{ij}^{P}\right)} exp\left(-\frac{\gamma m_{ij}^{P}}{\overline{\gamma}_{ij}^{P}}\right) \ldots (1)$$

Themoment generating function (MGF) of the instantaneous SNR as

$$M_{\gamma ij}(s) = E(e^{-s\gamma ij}) = \prod_{p=1}^{p_{ij}} \left(+\frac{s\gamma_{ij}^{-p}}{m_{ij}^{p}}\right)^{-m_{ij}^{p}} \ldots (2)$$

Using the fraction decomposition for*Mγij(s)*

$$M_{\gamma ij}(s) = \sum_{p=1}^{p_{ij}} \omega_{ij}^{p} \left(1 + \frac{s\gamma_{ij}^{-p}}{m_{ij}^{p}}\right)^{-m_{ij}^{p}}$$

Taking inverse Laplace of *Mγij (s)* from equation (2).

$$f(\gamma) = \frac{1}{(P-1)!} \overline{\gamma}^{P} \int_{0}^{\gamma} e\left(\frac{-\gamma}{\overline{\gamma}}\right) \gamma^{(P-1)} d\gamma \ldots (3)$$

Solve the f (γ) function with the help of standard integration equation is

$$f(x) = \int x^{v-1} e^{-\mu x} dx$$

$$f(x) = \mu^{-v}\ Inc\ \gamma(v, \mu)$$

Where $v = P$ and $\mu = \frac{1}{\gamma}$

$$f(\gamma) = \left(\frac{1}{\gamma^{-P}}\right) Inc\ \gamma(P, \frac{1}{\gamma})$$

$$f(\gamma) = \frac{1}{(P-1)!}\gamma^{-2P}\ Inc\ \gamma\ \left(P, \frac{1}{\gamma}\right) \ldots\ldots (4)$$

A class of wireless problems is characterized by the availability of the moment generating function of the reciprocal of the signal to noise ratio. The results allow a simple, accurate numerical calculation outage. Above equations describes about the outage analysis which is further describe in the simulation results below from which it is clear that Outage is getting reduced as number of path P is increased.

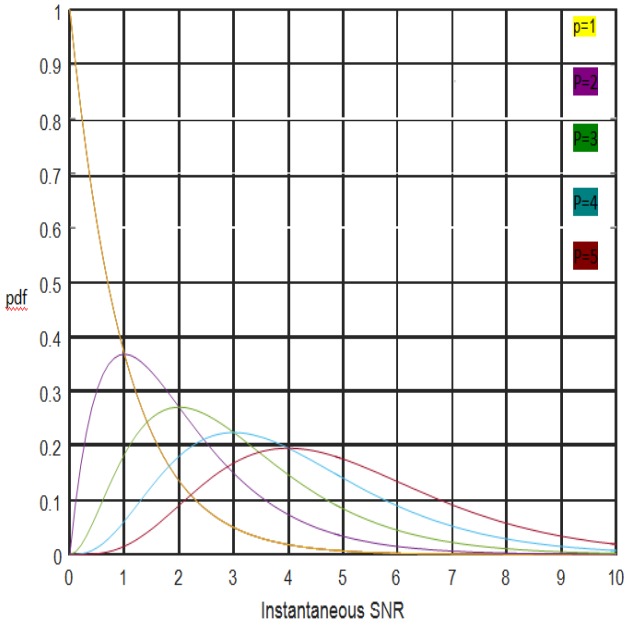

Fig.3 outage for IDMA system

CONCLUSION: Presently, no study has focused on outage performance in Interleve division Multiple access(IDMA) system using Rayleigh fading Channel. When p=1 the pdf starts decreasing with respect to instantaneous SNR but when the value of P increases to 2 then it starts increasing and becomes more accurate as the value increases further. In the combined graph it is clear that the response become more sharp and clear for more duration. It can be further more can be improved with different strategies which can be used to get more accurate results.

REFERENCES

[1] A. Nosratinia, T.E. Hunter, A. Hedayat, "Cooperative communication in wireless networks," IEEE Commun. Mag., vol.24, no.10, pp.74-80, Otc, 2004.

[2] E.G. Larssson, B.R. Vojcic, "Cooperative transmit diversity based on superposition modulation," IEEE Communications Letters, vol.9, no.9, pp. 778-780, 2005.

[3] Mehmet Bilim, Nuri Kapucu, and Ibrahim Develi, "A Closed-Form Approximate BEP Expression for Cooperative IDMA Systems over Multipath Nakagami-*m* Fading Channels", IEEE communications letters, VOL. 20, NO. 8, AUGUST 2016

[4] Zhiguo Ding, Ratnarajah, T., Cowan, C.,"Cooperative multiple access systems using superposition modulation," IEEE Information Theory Workshop 2006, Chengdu, China, pp. 497-501, 2006.

[5] Chengkang Pan, YuemingCai, YouyunXu, "Relay MAC channels: capacity and resource allocation," IEEE, VTC2007-spring, pp.29002904, 2007.

[6] Ishii K., ”Cooperative transmit diversity utilizing superposition modulation,” IEEE, Radio and Wireless Symposium, pp.337-340, 2007.
[7] Ishii K., ”Coded cooperation protocol utilizing superposition modulation for half-duplex scenario,” IEEE, PIMRC 2007, pp.1-5, 2007.
[8] Tao Yang, Jinhong Yuan, ”Performance of cooperative spatial interleaved superposition modulation in fading multiple-access channels,” IEEE, ICC’08, pp.891-895, 2008
[9] Tuyen Bui, Jinhong Yuan, ”Iterative approaches of cooperative transmission based on superposition modulation,” ISCIT’07, pp.1423-1428, 2007.
[10] Li Ping, Lihai Liu, Wu, K.Y., ”On interleave-division multiple-access,” IEEE, ICC04, pp.2869-2873, 2004.
[11] Mahinthan, V., Cai Lin, Mark, J.W., ”Maximizing cooperative diversity energy gain for wireless networks,” IEEE Trans. Wireless Commun., vol.6, no.7 pp.2530-2539, 2007.
[12] Yan Chen, Peng Cheng, PeiliangQiu. ”Optimal Partner Selection Strategies in Wireless Cooperative Networks with Fixed and Variable Transmit Power,” IEEE, WCNC 2007, pp.4080-4084, 2007.

