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Intrusion Control in WCDMA using DRR

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Abstract

Decorrelating Rake Receiver is used in Wideband Code Division Multiple Access to suppress the intrusion in the received FM signal. In order to increase the signal to noise ratio at the receiver, MRC technique at the receiver is used. A separate correlation receiver be granted intended for every multipath signals, the time-shifted versions of the original signal be attempted to accumulate at the DRR receiver. Autocorrelation is reduced inside a signal or cross correlation in a set of signal. This process is achieved by multipath components which are practically uncorrelated from another when their relative propagation delay exceeds a chip period. This paper presents the basics of MRC technique used in DRR, Rake receiver, and design of RR in DRR. Also the usage of DRR receiver is introduced in WCDMA.

Keywords: Decorrelator, MRC, RR, WCDMA etc.,

Introduction

In CDMA systems, the WCDMA is an air interface that utilizes bandwidth of 5MHz and also referred to as IMT -2000. This 3g cellular network uses 2Mbps speed and 2g GSM .W-CDMA specifications originate from the 3GPP Radio Access Network (RAN) group of 3GPP and were frozen in Release 99.The advantage is that it increases network capacity and novel services are obtainable. Some procedure that is used to reduced auto- correlation inside a signal or cross correlation in a set of signal at the same time as preserving other features of signal is known as Decorrelating Rake receiver. Reduced cross talk in a multi-channel signal or in design of echo cancellers. DRR is a time delayed version of original signal and correlation refers to any of a statistical relationships invoking dependence i.e., statistical relationship linking two relationship between two random variables. Interruption that is arised in signal that can also be eradicated by using RR (Rake receiver) however it has several barriers to overcome the affect of multipath fading and it treats it as MAI (multiple access interference). So DRR is proposed that uses MRC (maximum ratio combining). [1] The basic idea of A DRR receiver was first proposed from A RAKE in 1956.

Decorrelating rake receiver

In order to decrease the autocorrelation signal whitening is followed. It can be attained by balancing the power spectrum of the signal chosen alike to that of a white noise signal. It is reduces cross correlation cross talk in a multi-channel signal or in a design of echo cancellers. [2]

Multipath Channel Model

Multipath be able to arise in radio channel in various ways for example, reflection and diffraction from buildings, and scattering from trees presented in Figure 1.

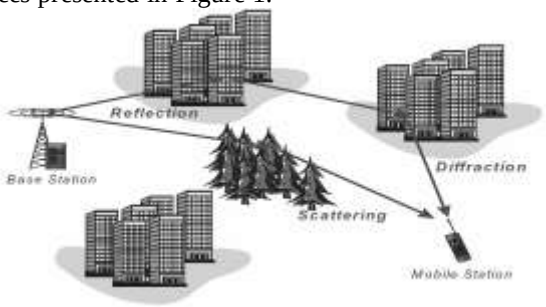

Figure 1. Propagation mechanisms

An N-ray multipath representation is an expansion to the multipath channel representation presented in [3]. Each of the N paths has an independent interruption, and an independent composite time-variant gain G. It consist of fingers from finger (1, 2…m) it indicates the time delayed version of the input signal.

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Interference

In this channel, two dissimilar sender sends transmit their data to different end nodes. Therefore the different senders can have a probable cross talk or co channel interference on signal of all. The inter cell interference on the signal of each other. The inter cell interference in cellular wireless communication is an example of interference channel. There are three methods of interference, they are unicast , broadcast, multicast.

Multiple Access Interference is a kind of interference produced by numerous cellular users who are using the identical frequency allotment at the similar time. AWGN is a channel representation in which the single destruction to the communication is a linear spot of wideband or white noise with stable spectral density. It is a random statistical noise having large frequency.

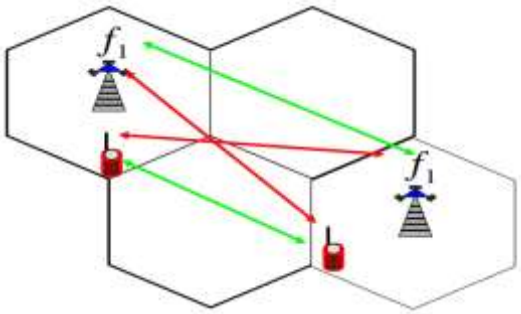

Figure 2: Co Channel Interference

Co –channel interference is a form of interference linking two cells using the similar frequency owing to frequency reuse. The red line represents the interference between TDD and FDD. The green line represents the interference between TDD only.

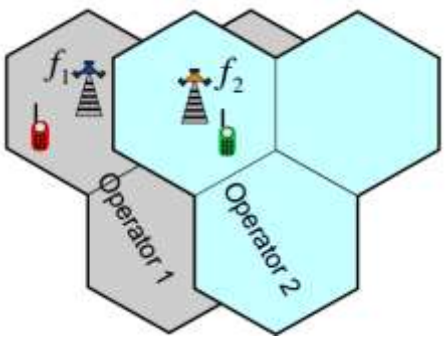

Figure 3 : Adjacent Channel Interference

Adjacent channel interference is a type of interference ensuing from signals which are nearby in frequency to the preferred signal. This is due to imperfect receiver filters which let nearby frequencies to drip into the pass band. The solution to this crisis is to be cautious filtering and appropriate channel assignments.

Decorrelating block receiver

De-correlate is to eliminate the co variances between observations. This may be made throughout highly structured orthogonal transformations, or by calculating separate horizontal and vertical fine tuning. It is a common phrase for any procedure with the intention of reducing autocorrelation inside a signal or cross-correlation in a set of signals, while preserving further features of the signal. A repeatedly used technique of decorrelation is the use of a matched linear filter to reduce the autocorrelation of a signal as far as possible. As the least promising autocorrelation for a given signal energy is attained by balancing the power spectrum of the signal chosen alike to that of a white noise signal, this is frequently referred to as signal whitening . Even though the majority of decorrelation algorithms are linear, non-linear decorrelation algorithms also present.

Decorrelation methods can also be used for numerous reasons, such as reducing crosstalk in a multi-channel signal, or in the design of echo cancellers. A wireless communication device for receiving a spread spectrum signal, the device containing a receiver front end to receive a composite spread spectrum signal and provide a sampled spread spectrum signal corresponding to the composite spread spectrum signal. A preponderance of filters arranged to be attached to the sampled spread spectrum signal, the filters having individual characteristics defined by filter coefficients and being operable to provide a output signals.

A coefficient generator, arranged to be attached to autocorrelation factors equivalent to the sampled spread spectrum signal and scattering of code information analogous to the spread spectrum signal. Towards clearly and completely conclude the filter coefficients such that the preponderance of filters realizes a decorrelating rake method. A coherent combiner merges the preponderance of output signals and offers a fused modeled output signal containing a reduced level of multiple access interference. The despreader is used to unstretch the merged sampled output signal. It afford the signal, in which the coefficient generator further involves an inversion processor to offer a matrix inverse analogous to the autocorrelation parameters. It is combined with the matrix inverse and the spreading code information to provide the filter coefficients.

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But the inversion processor uses one of a recursive construction and a pipelined design to grant the matrix inverse.

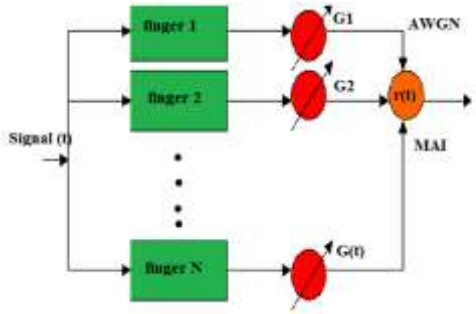

Figure 4 : Basic Structure Of Decorelator With RR Block

A decorrelating rake receiver with a signal processor and analogous method is used to validate filter coefficients. The decorrelating rake receiver contains a preponderance of filters prearranged selectively coupled to an input signal and the filter coefficients. The preponderance of filters operable to provide a preponderance of output signals and a coefficient generator, coupled to the input signal. Toward overtly and undeniably establish the filter coefficients for the preponderance of filters such that the filters execute a decorrelating rake process. The decorrelating rake receiver further consists of a combiner to mingle the preponderance of output signals and provide a received signal. The decorrelating rake receiver is suitable for use in a wireless communication device or base transceiver.

Existing system

Figure 5 depicts a basic diagram of a former art rake receiver. The conventional rake receiver comprises a path forager that depending on autocorrelation parameters which establishes the strongest few of the assorted multipaths and the coupled interruption for these multipaths. The path forager establishes the multipath hindrance outline that permits every subdivision of the rake to correlate its finger with the delayed ray received at the receiver. The output of the rake is followed by coherently collectived in the combiner with a specific algorithm such as maximum ratio combining. While the conventional rake receiver exploits a fixed set of correlation coefficients equivalent to the transmitter spreading code it is sub-optimum and does nothingto mitigate.

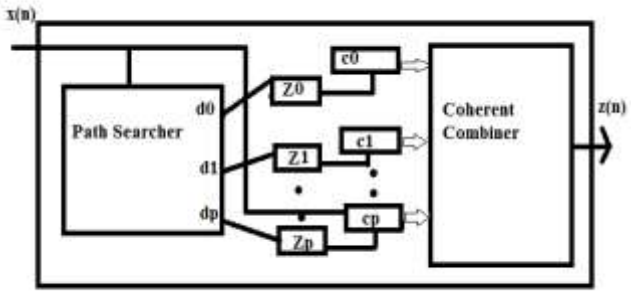

Figure 5 : Conventional Rake Receiver

Proposed system

Figure 6 illustrates a practical diagram of a decorrelating rake receiver. The pipelined design additionally consists of a preponderance of prediction calculators and a preponderance of matrix formulators intercoupled as illustrated and operable to offer the matrix inverse, [Rp]−1. Intermediate results or predictive information are stored in pipeline registers for outputs from the respective prediction calculators and in pipelined registers for outputs from the respective matrix formulators.

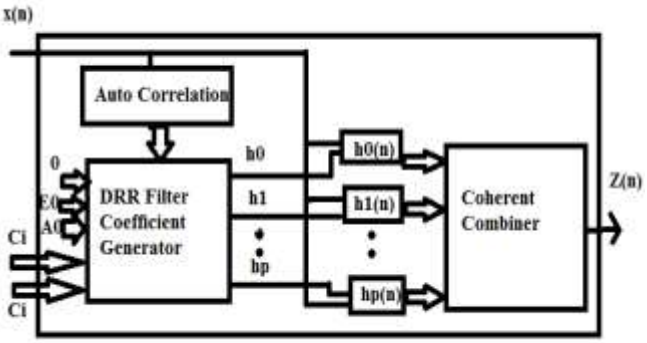

Figure 6 : Decorrelating Rake receiver using MRC Combiner

Algorithm

The output of DRR can be easily obtained by DMF (decorrelating matched filter) and a constant . DMF is used to remove MAI in front end . DMF is denoted as T by moore - penrose inverse of code matrix T . the output wit symbol m and user k is given as the multipath fading channel of user k h_k and m^{th} transmitted symbol of user k that is S_{km} . noise n is added to this equation form and denoted as n. noise is given or added to the received signal as AWGN(Additive white Gaussian noise) or noise vector T w. H_k represents arugument matrix as argmax(ghrkmg) .

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It is used to estimate channel and symbol with respect to number users.

$$U_{km} = (h_k X S_{km}) + n$$
$$n = diag(I\ X\ h_k)W$$

The gain of the signal received is denoted by G. and gh represents the upper triangle of gain and it is multiplied with the R as dominated eigen value . m^{th} is the transmitted symbol of k^{th} user and I is identity user . hkh denotes fading of user k in upper triangle . u_{km} gives the output of DRR with k user . Consider., Bit rate is 16,32,64 Chip rate is constant 3.84Mbps.

The spreading factor is given as , SF =chip rate/ bit rate

$$R_k = \frac{1}{M_k}\sum_{m=1}^{M_k} U_{km}U_{km}^H$$

MRC Technique

Maximal-Ratio Combining is the most advantageous form of diversity combining because it yields the maximal SNR achievable. It needs the accurate information of SNRs as well as the phases of the diversity signals. [4] After despreading the received symbol from transmitter via radio channel the symbols from allocated fingers are maximal-ratio-combined to construct the "combined" symbol. The output symbols from different fingers are multiplied with complex conjugate of the channel estimate and the result of multiplication is summed together into the "combined" symbol.

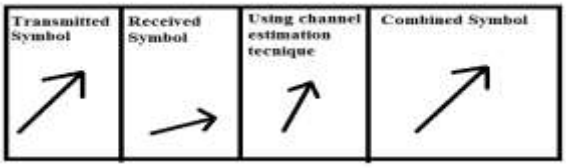

Figure 7 : Maximal Ratio Combining

EXPERIMENTAL RESULTS

From the Fig.8 , the number of users are 5 and SF of 16 . When the information is transferred the bit error rate is increased in DRR . The difference between the DRR and RR is of 2db . The y axis represents the BER and the x axis represents the SNR. It is obvious that when the data rate is increased the performance of RR is deduced but the performance of DRR is improved better. Thus the performance of the DRR is better even when the data rate is high . And so the performance is better in DRR.

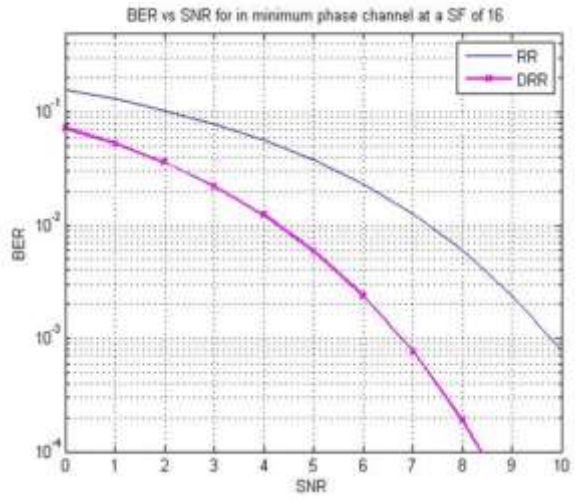

Figure 8: User 5 ; SF 16

From the Fig.9 graph , the number of users are 10 and SF of 32 . When the information is transferred the bit error rate is decreased in DRR . the difference between the DRR and RR is of 2db . the y axis represents the BER and the x axis represents the SNR. It is obvious that when the data rate is increased the performance of RR is deduced but the performance of DRR is improved better.

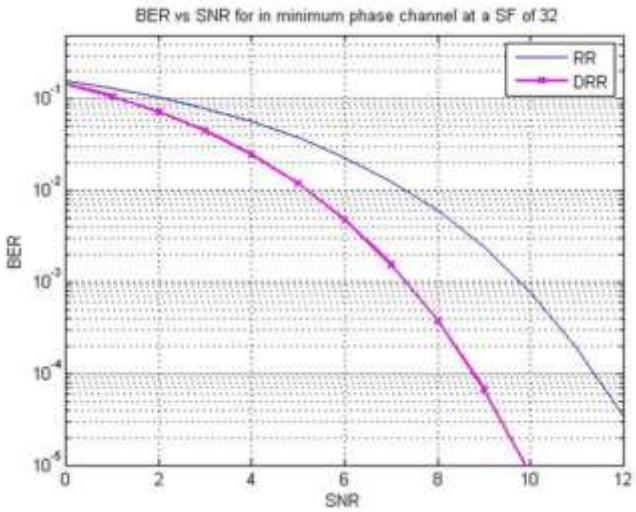

Figure 9: User 10 ; SF 32

From the above graph , the number of users are 15 and SF of 64. When the information is transferred the bit error rate is decreased in DRR . the difference between the DRR and RR is of 2db . the y axis represents the BER and the x axis represents the SNR. It is obvious that when the data rate is increased the performance of RR is deduced but the performance of DRR is improved better. Thus the

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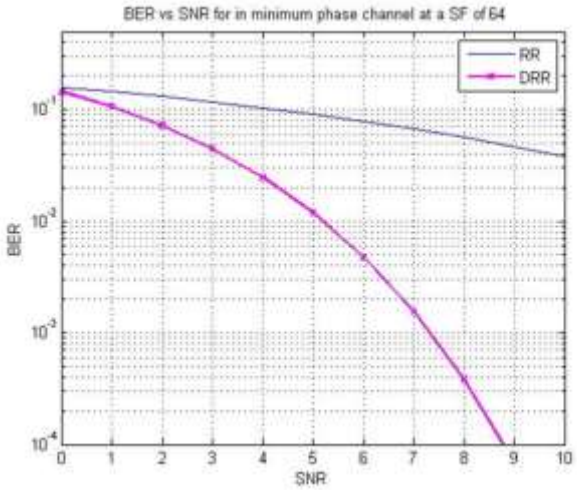

Figure 10: User 15 ; SF 64

Conclusion

In this paper, it has initiated the fundamental process and necessities of RAKE receiver used in WCDMA. RAKE receiver trys to accumulate the time-shifted versions of the original signal by providing a separate correlation receiver for every multipath signals. The RAKE receiver utilizes numerous baseband correlators to individually process numerous signal multipath components. The correlator outputs are combined to attain enhanced communications reliability and performance. The vital role of RAKE receiver are Channel delay estimation for multipath components, RAKE receiver finger allocation, descrambling and despreading operations, adaptive channel estimation, and Maximal-Ratio Combining. From the obtained graph it is obvious that intrusion is highly present in WCDMA. Using de-correlating rake receiver the intrusions occuring in WCDMA in reduced. And the performance is better when compared to rake receiver.

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