R.B.T.SUNDARI, MALLIKARJUNA REDDY.D, CH.RAMBABU / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 1, Issue 3, pp.923-928

Design & Simulation of a CDMA based Bidirectional Wireless Communication Data Link System for airborne Applications

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Abstract:-

Wireless communications is a rapidly growing segment of the communications industry, with the potential to provide high-speed high-quality information exchange between portable devices located anywhere in the world.

The present project will focus on the design and simulation of asecured CDMA based bidirectional communication data link for airborne applications. The scope of the project includes an initial literature survey to have a brief overview of current wireless systems and standards. We then characterize the wireless channel, including path loss for different environments, random log-normal shadowing due to signal attenuation, and the flat and frequency-selective properties of multipath fading. Next we examine the fundamental capacity limits of wireless channels and the characteristics of the capacity-achieving transmission strategies.

Thus, our focus will be on practical digital modulation techniques and their performance under wireless channel impairments, including flat and frequency selective fading mostly for AWGN channel. Out of the three techniques to combat frequency-selective fading : adaptive equalization, multicarrier modulation, and spread spectrum, our interest is to design and simulate a bidirectional wireless data link communication system making use of the multiple access capabilities of Direct sequence spread spectrum communication technique.

Keywords:-AWGN, CDMA, DSSS, Goldcodes

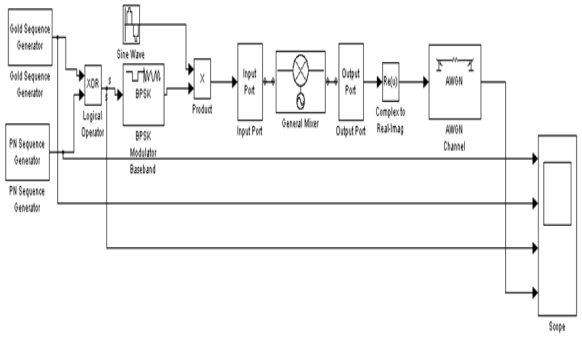
I. INTRODUCTION OF CDMA:

The present project will focus on the design and simulation of a secured CDMA based bidirectional communication data link for airborne applications. The scope of the project includes an initial literature survey to have a brief overview of current wireless

systems and standards. We then characterize the wireless channel, including path loss for different environments, random log-normal shadowing due to signal attenuation, and the flat and frequency-selective properties of multipath fading. Next we examine the fundamental capacity limits of wireless channels and the characteristics of the capacity-achieving transmission strategies.

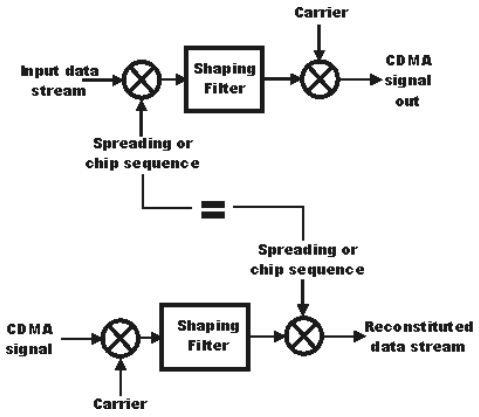
CDMA uses spread spectrum technology with the use of different codes to separate between different stations or users rather than different frequencies of time slots as in the case of previous access technologies. In this way, CDMA is different to the previous schemes used to provide different cellular users with access to the radio network.

II. Block diagram of wireless communication data link system:



III. CDMA codes and correlation:

The concept of CDMA is based around the fact that a data sequence is multiplied by a spreading code or sequence which increases the bandwidth of the signal. Then within the receiver the same spreading code or sequence is used to extract the required data. Only when the required code is used, does the required data appear from the signal.



CDMA system showing use of spreading codes

The process of extracting the data is called correlation. When a code exactly the same as that used in the transmitter is used, then it is said to have a correlation of one and data is extracted. When a spreading code that does not correlate is used, then the data will not be extracted and a different set of data will appear. This means that it is necessary for the same spreading code to be used within the transmitter and receiver for the data to be extracted.

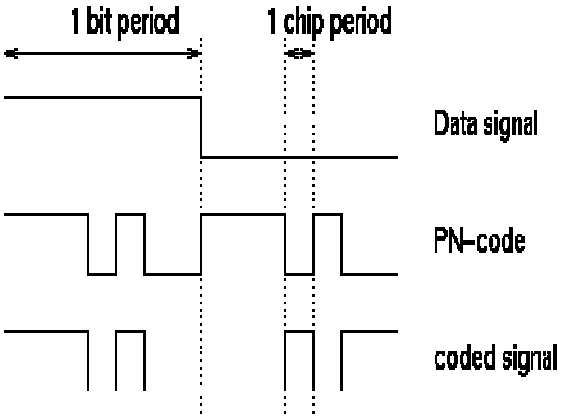


Fig. User signal and code are multiplied to generate the coded transmit signal

IV Code Properties:

Autocorrelation

The (normalized) autocorrelation of the spreading waveform *p(t)* is defined by

$$R_c(\mathrm{t}) = \frac{1}{T}\int_0^{inf} p(t)\,p(t+\mathrm{t})\,dt$$

where*p(t)* is the transmit waveform of the code, $T = N_cT_c$ is the code period time and t represents a time shift.

Partial Autocorrelation

If a bit transition occurs (from +1 to -1 or vice versa), the interference from a delay CDMA signal consists of two fractions of a bit duration. The Partial Autocorrelation is similar to the above formula, but integrated only of a portion of the bit duration.

Cross correlation

Different signals have different spreading codes. The cross correlation between two codes *i* and *j* is

$$R_c(\mathrm{t}) = \frac{1}{T}\int_0^{inf} p_i(t)\,p_j(t+t)\,dt$$

Which equals the autocorrelation if $i = j$.

V. Gold Codes:

These are constructed by EXOR-ing two *m*-sequences of the same length with each other. Gold sequences have favorable cross-correlation properties. See also the page about Gold-codes.

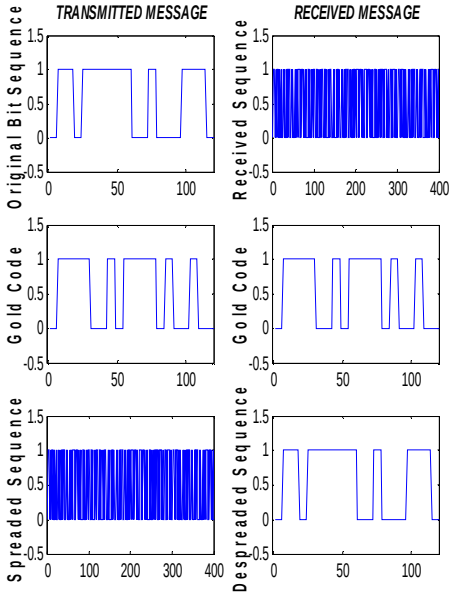
A Gold code, also known as Gold Sequence is a type of binary sequences, used in telecommunication (CDMA) and satellite navigation (GPS). Gold codes are named after Robert Gold. Gold codes have bounded small cross-correlations within a set, which is useful when multiple devices are broadcasting in the same range. A set of Gold code sequences consists of $2^n - 1$ sequences each one with a period of $2^n - 1$.

A set of Gold codes can be generated with the following steps. Pick two maximum length sequences of the same length $2^n - 1$ such that their absolute cross-correlation is less than or equal to$2^{(n+2)/2}$, where *n* is the size of the LFSR used to generate the maximum length sequence . The set of the $2^n - 1$ Exclusive ors of the two sequences in their various phases (i.e. translated into all relative positions) is a set of Gold codes. The highest absolute cross-correlation in this set of codes is $2^{(n+2)/2} + 1$ for even *n* and $2^{(n+1)/2} + 1$ for odd *n*.

VI.Preferred Pair m-Sequences for Gold Codes:

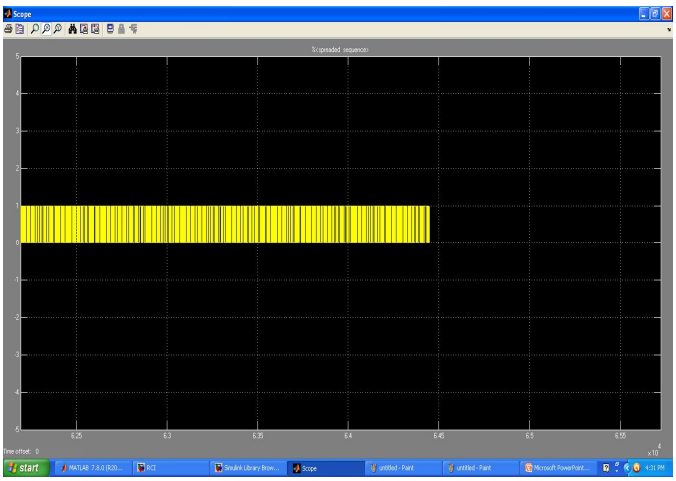
Spreading sequences in spread spectrum systems can be generated with help of diversified codes like m-sequences, Gold Codes, Kasami Codes, Walsh Codes etc. Compared to m-sequences (maximum length PN Sequences), Gold codes have worst auto-correlation properties but they have better cross-correlation properties. The sequences associated with Gold Codes are produced by binary addition

When the two m-sequences are picked randomly for Gold code generation, then the cross-correlation property of the generated Gold code might not be as good as expected. Gold codes are generated using "Preferred" pairs of sequences that will guarantee good cross-correlation (as well as auto-correlation) properties of the generated Gold code. A method for selecting the preferred pairs for Gold Code generation was given by Robert Gold.



VII. Features of Proposed system:

- Range of operation:≤ 100 mt
- Frequency of operation: X-band
- Data rate :9.6kbps



- Carrier modulation: BPSK
- BER:1 in 10^6
- Receiver sensitivity: -110 dBm
- Code of operation: Gold code

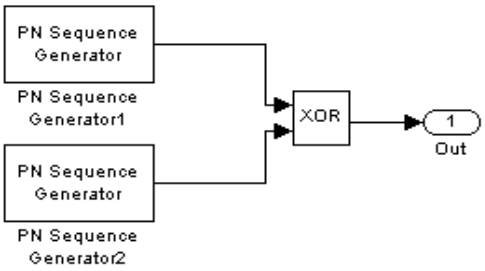
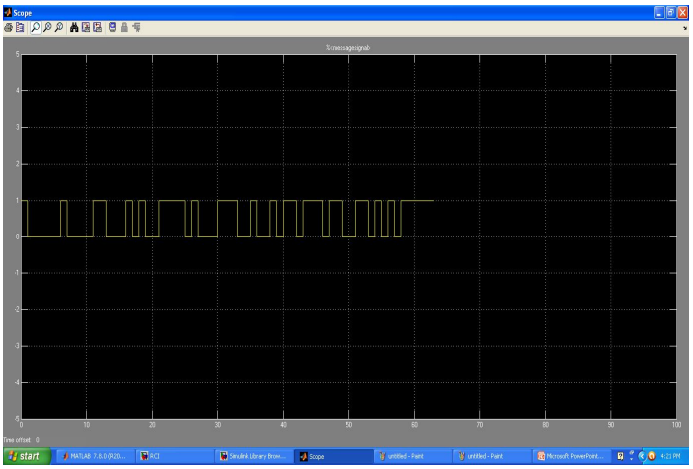
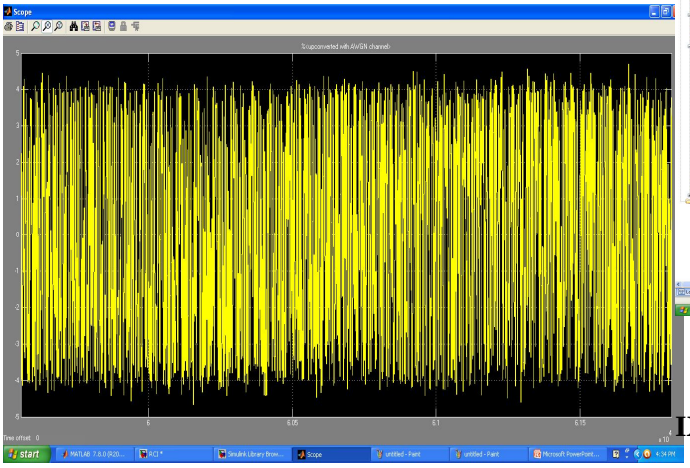
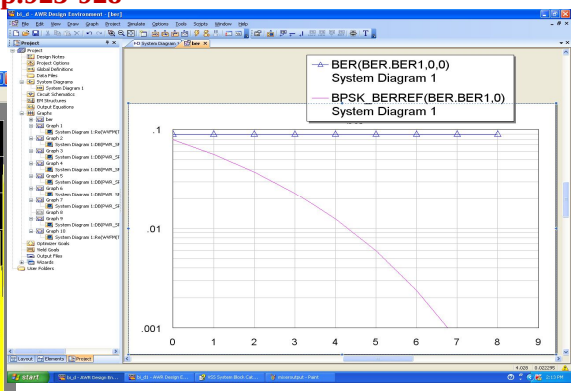


Fig. Block Diagram to show Gold Code operation

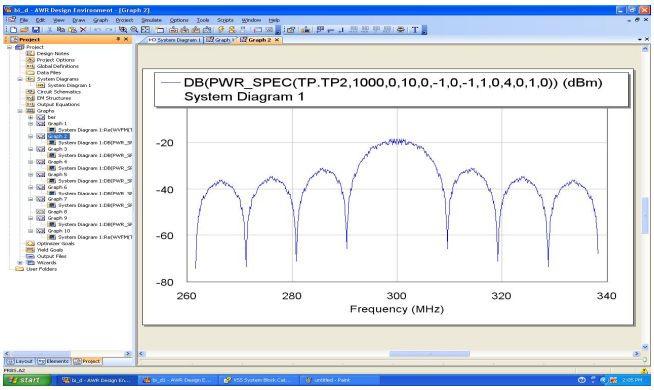


VIII. Simulation Results:





PSD of Transmitted signal:



BER performance of proposed system:

IX.Conclusion:

Here I am paying great attention to the topic of CDMA based bidirectional communication data link for air borne applications. After then i have characterize the wireless channel, including path loss for different environments, random log-normal shadowing due to signal attenuation, and the flat and frequency-selective properties of multipath fading. The project concludes with the complete design of a bidirectionaCDMA based wireless communication data link system and its simulation using AWR.

X.References:

1.http://gaussianwaves.blogspot.com/2010/preferred-pairs m sequencesgeneration.html

2.http://www.mathworks.com/matlabcentral/linkexchange/links/2323-preferred-pairs-m-sequences-generation-for-gold-codes

3. CDMA Based Wireless Transceiver System MATLAB Simulation and FPGA Implementation. Mahtab, Z.; Ahmed, S.J.; Hussain, S.S.; Hasan, S.;N.E.D Univ. of Engg. & Tech., Karachi

4.E.H. Dinan, B. Jabbari, "Spreading codes for direct sequence CDMA and wideband CDMA cellular networks, IEEE Communications Magazine, pp. 48-54, September 1998.

5. R.Gold. Optimal binary sequences for spreadspectrummultiplexing.IEEETrans.Info.Theory, IT{B:619{621,,Oct 1967