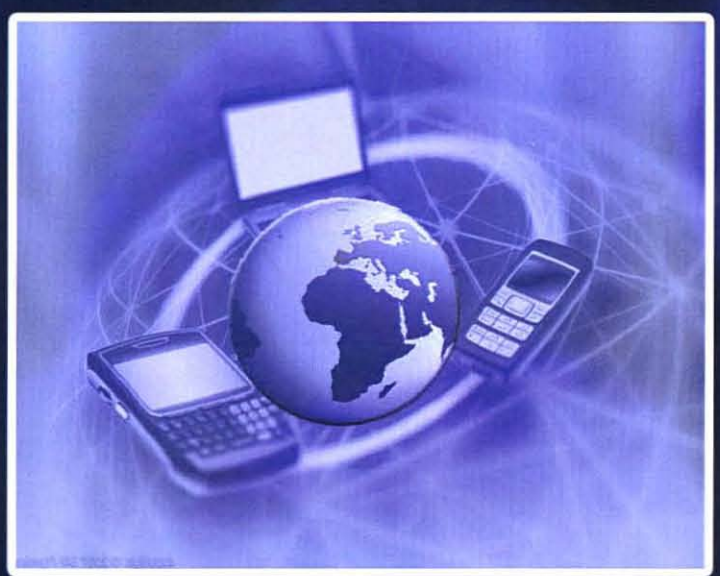
Research Issues in Wireless

Communications and Networking

Farhat Anwar
Wajdi Al-Khateeb



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CHAPTER 3

IMPLEMENTATION OF A DS-SS CDMA TRANSMITTER AND RECEIVER

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3.1 INTRODUCTION

Spread Spectrum Communications is one of the widely used data communication schemes nowadays. It has many features that make it suitable for secure, multiple accesses, and many other properties that are needed in a communication system. Spread Spectrum is defined as: Spread Spectrum is a means of transmission in which the signal occupies a bandwidth in excess of the minimum necessary to send the information. The band spread is accomplished by means of a code, which is independent of the data, and synchronized reception with the code at the receiver is used for dispreading, and subsequently data recovery. Basically spread spectrum is a coding technique for digital transmission. It was originally developed for the military under a veil of secrecy. The purpose of coding is to transform an information signal so that it looks more like noise. In the receiver, the incoming signal is decoded, and the decoding operation provides resistance to interference and multi path fading. The spreading or dilution of energy in spread spectrum systems over a wide bandwidth results in several possible advantages, short-range interferences-free overlays on their emissions, and resistance to interference, from other emissions, and low detestability. The low spectral density needed for spread spectrum communication systems, as well as ability of some of these systems to process signals that are carried far into the noise, offer a potential for shared spectrum use with existing Systems on a non-interference basis. Finally, Spread spectrum systems could be useful in applications to control multi path interference [1].

Spread Spectrum communication techniques provide a new method of multiple access, known as CDMA (Code Division Multiple Access) that is proposed as an interesting alternative with respect to the traditional methods, i.e.: the well-known TDMA (Time Division Multiple Access) and FDMA (Frequency Division Multiple Access) [2]. The main parameter in spread spectrum systems is the processing gain the ratio of transmission and bandwidth has shown in equation 3.1.

$$G_p = \frac{BW_{ss}}{BW_d} \qquad (3.1)$$

The processing gain determines the number of users that can be allowed in a system, the amount of multi-path effect reduction, the difficulty to jam or detect a signal etc. For spread spectrum systems it is advantageous to have a processing gain as high as possible. A PN code is a sequence of chips valued -1 and 1 (polar) or 0 and 1 (non-polar) and has noise like properties. This results in low cross-correlation values among the codes and the difficulty to jam or detect a data message. Several families of binary PNcode exist, they are addressed in another. A usual way to create a PNcode is by means of at least one shift-register. When the length of such a shift-register is n, the following equation 3.2 can be said about the period of the above mentioned code-families: