FACULTY OF ENGINEERING & TECHNOLOGY

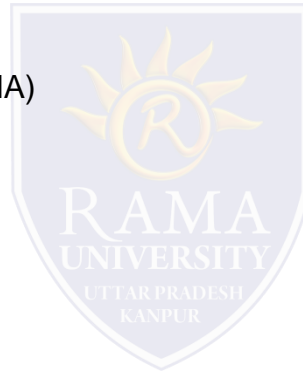## Brajesh Mishra

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Code division multiple-access (CDMA)
Categories of Code division multiple-access (CDMA)
Key elements of CDMA
Space division multiple access (SDMA)
Frequency hopped spread spectrum (FHSS)
Direct sequence spread spectrum (DSSS)

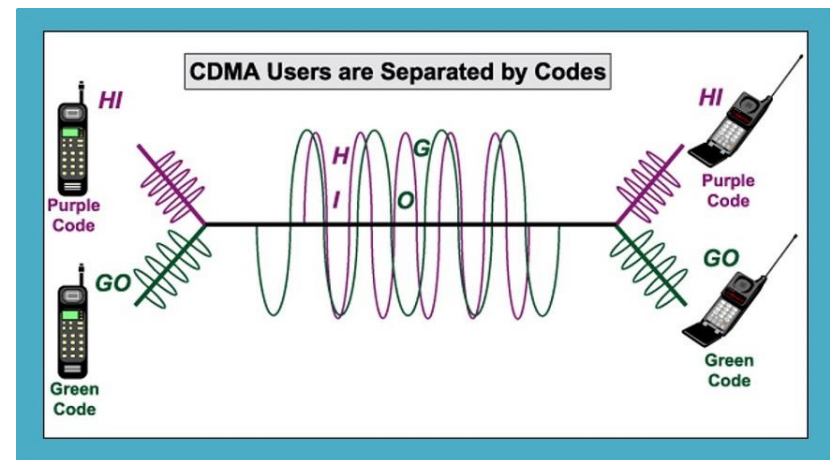# Code division multiple-access (CDMA)

Code division multiple access technique is an example of multiple access where several transmitters use a single channel to send information simultaneously. Its features are as follows.
In CDMA every user uses the full available spectrum instead of getting allotted by separate frequency.
CDMA is much recommended for voice and data communications.
While multiple codes occupy the same channel in CDMA, the users having same code can communicate with each other.
CDMA offers more air-space capacity than TDMA.
The hands-off between base stations is very well handled by CDMA.

Categories of Code division multiple-access (CDMA)

CDMA belongs to two basic categories:
Synchronous CDMA
Asynchronous CDMA

Synchronous CDMA
Synchronous CDMA is defined as exploiting the mathematical properties orthogonally between vectors representing the data strings. This digital modulation method is analogous to the one used in simple radio transceivers.

For example, let us consider a binary string "1011" which is represented by the vector (1, 0, 1, 1). These vectors can be multiplied by taking their dot product and sum of products with respect to the components. If dot product is zero, then the two vectors are said to be in orthogonal.

Asynchronous CDMA
If mobile-to-base links are not exactly matched, particularly due to handsets mobility, a different approach is required. This type of CDMA is not mathematically possible to create signature sequences which are orthogonal for arbitrarily random starting points, and thus make use of the code space. Pseudo-random or pseudo-noise sequences are used in asynchronous CDMA systems.

Key elements of CDMA

Multiple accesses: The use of spreading codes which is independent for each user along with synchronous reception will allow multiple users to access the same channel simultaneously.

Use of Wide Bandwidth: CDMA like other spread-spectrum technologies uses a wider bandwidth than would otherwise be needed for the transmission of data. This results in a number of advantages including an increased immunity to interference and multiple user access.

Level of Security: In order to receive the data, the receiver synchronizes the code to recover the data. The use of an independent data and synchronous reception allows multiple users to access the same frequency band at same time.
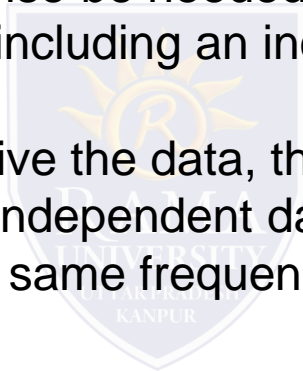
Spread spectrum multiple access (SSMA) uses signals which have a transmission bandwidth whose magnitude is greater than the minimum required RF bandwidth.

There are two main types of spread spectrum multiple access techniques −
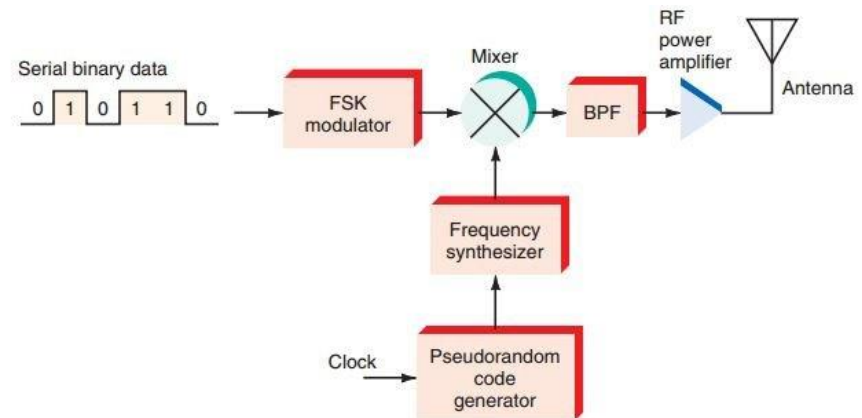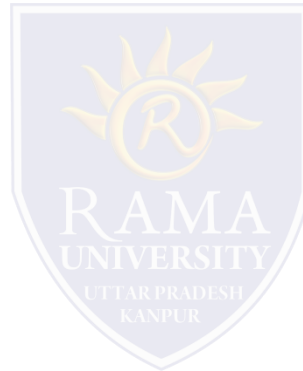
Frequency hopped spread spectrum (FHSS)

Direct sequence spread spectrum (DSSS)

Frequency hopped spread spectrum (FHSS)

This is a digital multiple access system in which the carrier frequencies of the individual users are varied in a pseudo random fashion within a wideband channel. The digital data is broken into uniform sized bursts which is then transmitted on different carrier frequencies.

This is the most commonly used technology for CDMA. In DS-SS, the message signal is multiplied by a Pseudo Random Noise Code. Each user is given his own code word which is orthogonal to the codes of other users and in order to detect the user, the receiver must know the code word used by the transmitter.

The combinational sequences called as **hybrid** are also used as another type of spread spectrum. **Time hopping** is also another type which is rarely mentioned. Since many users can share the same spread spectrum bandwidth without interfering with one another, spread spectrum systems become **bandwidth efficient** in a multiple user environment.