# Design and Implementation of Frequency Synthesizer and Mixer for VLPT

By

Abhijit Ganpat Shinde

MIS No: 121334001

Under the guidance of: Mrs. D. V. Niture

## Abstract:

Very Low power transmitters in VHF and UHF band can provide sufficient bandwidth and range to cover few villages in rural areas for transmission of audio visual educational content. Such transmitters can be established solely for community education and managed by existing schools as additional support for children and support for adult education in the area. Content for such education is abundant and freely available from various education promotion programs by national government, state governments, private NGO as well as international organizations such as UNO, UNDP, UNESCO, ILO etc. So the objective of this project is to design and implement the frequency synthesizer which can support this system to operate in VHF range of EU standard band III. And to subsequently design the frequency mixer to up-convert the modulated signal from SDR using the output of frequency synthesizer as LO signal. The up-converted signal is transmitted in any of the 8 channels of VHF band III i.e. from 147MHz to 230MHz having 8 channels with bandwidth of 7MHz.

# Accident Prevention and Road Traffic Monitoring Using VANET

By

Anil Meshram

121334002

Under the Guidance of

Dr. R. A. Patil

To avoid accidents and traffic jams on the roads vehicular ad hoc networks (VANETs) is the best solution which provides IEEE 802.11p based wireless communication between vehicles to vehicles and vehicles to infrastructure which operates in the Dedicated Short Range Communication (DSRC), frequency band of 5.85-5.925 GHz. These types of communications allow vehicles to share different kinds of information like traffic safety information, vehicles speed, and position, provided by the number of sensors.

In this work we have followed Taguchi method for the simulation of different scenarios for efficient sending of emergency warning messages and simulation results were obtained using NS-2 simulator. Experiments have been performed and the results have been noted for Packet delivery ratio, Average end to end delay, Packet loss and Throughput. The results are noted and analysis was done. We conclude with the best parameter value for optimized solution and get better performance in case of packet delivery ratio and average end to end delay.

# A Dynamic Power Allocation Algorithm for Broadband Multi-Beam Satellites

Anshu A. Barethiya (**121334003**) (Wired & Wireless Communication)

Project Guide: Dr. S. P. Mohani

# Abstract

In today's world, broadband multi-beam satellite networks play a substantial role in worldwide telecommunication and providing direct satellite services to users. Geostationary satellite has always been serving as the backbone of the commercial satellite communication networks. In broadband satellite communication, the high frequency bands are generally used. At these frequencies, there are various impairment factors that degrade the quality of signals. Among these factors, rain attenuation is the dominant factor at frequencies of 10 GHz and above. Using different models for rain attenuation prediction and power allocation algorithm, it has been shown that the number of served users by satellite services is increased. In this project, a new dynamic power allocation algorithm is proposed, which provides better results in terms of time elapsed and number of users served. The advantage of algorithm is the simplicity with which it allows the simulation. This is important for complex models of adaptive networks, where finite response time is of great importance.

# DESIGN AND ANALYSIS OF COMPACT TWO PORT MIMO MICROSTRIP ANTENNA FOR 4G APPLICATIONS

By
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**(121334004)**

Under The Guidance of
**Prof. Mrs. D. V. Niture**

## ABSTRACT

Multiple-Input-Multiple-Output (MIMO) systems provide a significant increase in channel capacity without the need of additional bandwidth or transmit power by deploying multiple antennas for transmission to achieve an array gain and diversity gain, thereby improving the spectral efficiency and reliability. Since MIMO systems employ multiple antennas, they require high decoupling between antenna elements. The need to deploy more than one antenna leads to the problem of the restricted available space reserved for the antennas, especially on the terminals. Another fundamental problem is the evaluation of the MIMO performance in a realistic propagation environment. On mobile terminals, usually only a limited surface area for antennas is available. Therefore multiport antennas with small dimensions are requested, which offer sufficient decoupling between the ports.

Goal of this project work is to achieve two port antenna structure with low reflection coefficient at each port, high decoupling between the ports and most important to guarantee the decorrelation between the radiation patterns. A concept for a compact multiport antenna is referred, to design a planar two port microstrip MIMO antenna suitable for 4G Applications. The antenna resonates at 2.58 GHz with operating bandwidth of upto 69 MHz. To improve decoupling between the ports, basic design was modified to achieve inter port isolation parameters better than -28 dB and an excellent correlation coefficient 0.007. Finally the system performance of this antenna was analysed based on the comparison between simulated and measured S-Parameters and correlation coefficient of the designed two port antenna.

# “Design of Rectangular Microstrip Antenna for WLAN/WIMAX with Defected Ground Structure”

By
Bhushan Sarode
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**Under The Guidance of**
**Prof.A.M.Sapkal**

## Abstract:

In this project, design, optimization, and analysis of microstrip antenna with DGS and reflector is presented. The antenna is designed on low cost FR-4 substrate having εr=4.4, with loss tangent 0.02. Antenna is fabricated with optimized dimension of 30.2×39×1.6.Antenna is excited by microstrip line feed. The proposed antenna has impedance bandwidth of 451 MHz which is 18.3% of the resonance frequency. This can operate in allocated frequency band for Wi-Fi, WiMAX. Modifying with defective ground plane bandwidth of proposed antennas optimized. The gain of proposed antenna is enhanced by introducing reflector at a distance λ/10 below the ground structure. The proposed antenna has excellent gain of 6.68dBi. Analysis of antenna is done with help of theory of characteristic mode. Modal significance, Characteristic angle, Eigen value provide better insight characteristic of microstrip antenna. The simulation result is obtained using CAD-FEKO which uses MoM.

# Design, Simulate and Validate Polarization Diversity

By

Nikita Dukare

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Under the guidance of:

Dr. S. P. Mahajan

Abstract:

People's demands for faster transmission and reception of information seem endless and have been the driving force behind the progress of wireless technology. The diversity systems implemented using multiple input multiple output (MIMO) are very much useful for the purpose of increasing data rate and efficient usage of bandwidth by exploiting effect of multipath fading in wireless communication. There are many types of achieving diversity in multiple antenna (MIMO) systems such as spatial diversity, time diversity, frequency diversity, pattern diversity, polarization diversity etc.

Polarization diversity is the diversity scheme in which polarization of signal plays a important role. Orthogonal polarizations such as left handed circular polarization (LHCP) and right handed circular polarization (RHCP) are used in this system to achieve diversity goal. Microstrip antenna is designed to generate dual polarization branches to transmit and receive information along two channels of orthogonal polarization. When the signal travel through wireless communication channel, it will undergo depolarization i.e. change in polarization state because of reflection, refraction, diffraction from obstacles in the path. Hence multiple copies are received at the receiver side. But the signal with polarization matching to transmitter polarization will have maximum power among all multiple copies. And thus that signal can be selected and can be forwarded for further processing. Thus without additional space requirement, the efficient usage of the limited bandwidth can be achieved.

# Design, Simulate & Validate Antenna Diversity System

By
Aditya S Gaidhane
121334008

Under the guidance of:
**Prof.S. P. Mahajan**

## Abstract :

In this project work design 2-patch & 4-patch microstrip antenna Design for the ISM band Operating at 2.45 GHz frequency, using low cost Glass E-proxy Fr4 substrate having dielectric constant of 4.4 simulated using Cad-FEKO. With For sampling power, a 15 dB directional coupler is designed by using AWR software & a 2-Layer PCB using Eagle Software on Glass E-proxy Fr4 substrate.

The main reason for such interest is that an antenna diversity system has the potential of providing more spectral efficiency and better transmission quality. Hence, beyond the original purpose of transmitting and receiving, it is possible to provide more services which require a higher data rate. Antenna diversity systems can provide a diversity gain by transmitting several copies of the signal. On the other hand, multiplexing gain is also feasible by sending independent data streams and therefore, higher capacity is achievable.

# Design of Antennas to Detect the Coronal Mass Ejections (CME's) From the Sun

**By**

SHRIDHAR K GALANDE
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**Under the guidance of**

Dr. R.A.PATIL

## ABSTRACT

Coronal mass ejections (CMEs) consist of large structures containing solar winds and magnetic fields that are expelled from the Sun into the heliosphere. They can disrupt radio transmissions, cause damage to satellites and electrical transmission line facilities, resulting in potentially massive and long-lasting power outages.

The Antenna is subjected on spacecraft to detect and measure the Coronal Mass Ejections (CMEs) from the sun and their interaction with the interplanetary medium and terrestrial. This is Low frequency Radio Experiment (LORE) is a proposed space payload for space weather observations from space, operating between few KHz to 30 MHz. This project presents preliminary design and practical implementation of LORE antenna systems, which consists of three mutually orthogonal monopoles. The three monopoles antenna system is used to get as uniform sensitivity as possible, a reasonable directional beam and high gain as possible. The designing of antennas at this operating frequency is a challenging task for designers because the antenna has large physical size and low electrical length. Interplanetary radio bursts are generated from electron beams at interplanetary shocks and solar flares and are observed from the sun. This phenomenon is measured by using three monopole antennas or three dipole antennas which are orthogonal to each other and mounted on the spacecraft. At the low frequency range monopole antenna is preferred to dipole because of monopole requires less physical size. Designing of three monopole antennas are similar to STEREO/waves (Solar Terrestrial Relations Observatory). The design of three dipole antennas is mutually orthogonal to each other. Design three dipole antennas in such a way to get a wide operating frequency band and reduce the physical size by using meandering concept.

The design and simulation analysis carried out through CAD-FEKO software. FEKO is a comprehensive electromagnetic simulation software tool, based on state of the art computational electromagnetic (CEM) techniques. It enables users to solve a wide range of electromagnetic problems.

# Design and Implementation of Microstrip Antenna for TVWS Application Using Defected Ground Structure

By

Subodh B. Gite

Mis No:121334010

Under the guidance of:

Asst. Prof. D. V. Niture.

## Abstract:

Cognitive radio is a new age technology which improve the utilization of frequency spectrum by sensing the white spaces. Whitespaces are available in TV and can be utilized using TV white space cognitive radio and used for application like rural broadband services. For such cognitive radio a wideband antenna requires which can operate over a large band and can sense frequency band which are not used at that instance. Such antenna is designed in this report.

A wideband planar monopole antenna for TV white space (TVWS) application in the band of 623MHz-860MHz is presented. Defected ground structure (DGS) is used for bandwidth enhancement and size reduction. The designed antenna has overall size of 128mm x 64mm which is comparable to portable devices like Smartphone. The proposed antenna has gains ranging from 1.4 to 2.1dBi which are fairly good for TVWS applications**.** Experimental result shows that antenna gives monopole-like omni-directional radiation pattern and applicable to TVWS applications.

# Performance Improvement of Wireless Communication System by Changing Modulation Methods using Software Defined Radios

By

**Vishal D.Jadhav**

(121334011)

**Guide :**

**Prof. R. D. Joshi.**

According to the Federal Communications Commission (FCC) in a Software Defined Radio (SDR) functions are formerly carried out in a hardware, such as the generation of the transmitted signal and the tuning and detection of the received radio signal are performed by software that controls the high speed signal processors.

This ideal radio defined by the SDR forum has, until recently, been unachievable due to the lack of very high-frequency RF to digital converters capable of converting carrier frequencies directly to digital data [17]. Now new integrated circuit processes are offering higher speed and lower power .State–of–the IC design is being applied to these new processes to enable RF to digital conversion directly on carrier frequencies above 5GHz.

Digital communications devices designed with application-specific integrated circuit (ASIC) technology suffer from one very significant limitation—the integrated circuits are not programmable. Therefore, deploying a new algorithm or an updated standard requires new hardware. Field-programmable gate arrays (FPGAs) solve this problem by introducing what is essentially reconfigurable hardware. Thus, digital communications devices designed on FPGAs are capable of accommodating multiple communications protocols without the need to deploy new hardware, and can support new protocols in a matter of seconds. In addition, FPGAs provide a means to update systems that are physically difficult to access. For these reasons, FPGAs provide us with an ideal platform for implementing adaptive communications algorithms.

This project is focused on an automatic switching of modulation method or Dynamic Reconfiguration of Modulation Techniques to reconfigure transceivers of Software Defined Radio (SDR) based on wireless communication and implementation of prototype of proposed system on FPGA using Xilinx FPGA Spartan-6 XC6SLX9 Development Board.

# Design and Implementation of Preamplifier for RF Receiver

By

Sachin Jamadar

121334012

Under the Guidance of

Dr. R. A. Patil

To design preamplifier is a crucial thing and challenging task at the receiver since received signal will always be weaker in amplitude and corrupted by noise in wireless communications. It should provide high gain, low noise figure, stability not only at one frequency but over range of frequencies or bandwidth of interest. We need an optimization and fine tuning of component values to get the optimum or most favorable results. Basic objective of this project is to achieve maximum gain for low frequency (16 KHz to 30 MHz).

For specific applications in radio astronomy, it's desirable to have wider bandwidth. Maintaining desired noise figure, gain, stability will also be an essential part of the project. Minimum noise matching principle is required at the input side and maximum gain principle and it's flatness at the output side. We are going to design preamplifier having frequency range (16 KHz to 30 MHz) to achieve gain of (20 dB) using AWR and MULTISIM software.

# Empirical Mode Decomposition for Discrimination of Different Noisy Audio Categories

by
Sujay D. Mainkar
(MIS No.: 121334013)
Under the guidance of:
Dr. S. P. Mahajan

## ABSTRACT

Imagine that you are listening to an audio recording, in which you can hear vehicles passing by, people walking and talking, some small kid crying in the background for buying certain toy, hawkers shouting to sell their products and you may even feel a gust of wind blowing into microphones. If you were asked about the location of the recording, you would probably answer that the recording is from a busy marketplace. In this narrated situation, you would be performing the task of soundscape recognition and discrimination. The goal of this work is to develop a methodology that enables a computerized system to do the same.

The primary objective of this work is to implement Empirical Mode Decomposition based feature extraction and efficient classification techniques for the purpose of noisy audio discrimination in real-world unstructured environments. Unstructured environments are those where adverse effects such as noise, distortion and interference are likely to dominate. Noisy audio discrimination refers to the task of associating a semantic label to an audio stream that identifies the environment in which it has been produced. The target is to design a system that can achieve human-like sound recognition performance on a variety of hearing tasks in diverse environments; irrespective of the change in Signal-to-Noise ratio (SNR) levels.

As a class of sounds, environmental sounds are worth studying because of their ability to convey semantic information based on complex acoustic structure. Yet, unlike other large meaningful audio categories, that is, speech and music, the information conveyed by real-world acoustic sounds is neither linguistic, as in speech nor designed for its aesthetic value alone, as in music. Therefore, it is important to develop a system which can perform well for this challenging task.

In this work of EMD based noisy audio discrimination, two novel ways of composite feature set formation, namely-(i) Uni-Feature Multi-IMF (UFMI) and (ii) Multi-Feature Uni-IMF (MFUI) are suggested. So, the temporal and spectral features are extracted from the IMFs of various noisy audio signals. The entire experimentation is carried out with the help of two different datasets namely – NOIZEUS speech corpus and DEMAND database. Further, for discrimination of noise sources into different categories, three classifiers namely- Gaussian mixture model (GMM), k-nearest neighbor (k-NN) and support vector machines (SVM) are used. Finally, classifier performance is evaluated with the help of different machine learning metrics. The proposed approach proved to be promising for noisy audio discrimination yielding considerably better results with ZCR-STE-MFCC (MFUI) feature set.

# DESIGN AND IMPLEMENTATION OF ANTENNA TEST RANGE

by

**Kaiwalya Sanjay Pethe**

(MIS No. 121334014)

**Guide (s):**

**Prof. Dr. S. P. Mahajan**

## Abstract

Since last 50 years, many complex methods of antenna analysis like Finite Difference Time Domain, Method of Moments, and Finite Element Analysis have been developed. These methods give us the solution for the E-plane, H-plane patterns, the directivity like parameters. But, the validation of these results was done using physical antenna testing under different test conditions. The place of testing antenna is called an antenna test range. There are different methods of testing antennas and accordingly different test ranges are designed.

This report introduces to different techniques for antenna testing, different types of test ranges. This report compares these types of ranges and gives an opinion on which type of ranges are suitable for different types of antennas. This report compares different types of antennas and provides a result of best suitable antenna to use as a reference antenna for testing of different antennas in the test range. The selection of test site is an important issue. This issue is addressed in the report.

The main aim of the experiment is to get the antenna test range working at RAC, Ooty. The results of the testing of the antennas at the test site are also written in this report. The selected antennas are tested for their circuit parameters and radiation pattern. All the results are mentioned in the report along with the comparison with the simulated results mentioned above.

The involvement of linear algebra in solving the electromagnetic equations has improved the efficiency by which the solution matches the actual results. And now there are a lot of different techniques invented to find the electromagnetic fields for the radiators. The report here includes one part of the experiment, the comparison between different solvers in terms of their performance parameters, available to find the solution to the wave equation. The solver methods compared are Finite Element Analysis Method (FEM), Method of Moments (MoM), Finite Difference Time Domain Analysis (FDTD).

The antenna design is a complicated task. And to get the antennas working as per the requirements is another level of complication in the process. The antennas need to be optimized for some parameters as per requirements. The FEKO software supports various optimization techniques like Particle Swarm Optimization, Simplex Neadler Mead method, and Genetic Algorithm. While the antenna design was in process, it was decided to try the optimization techniques too. The results of the techniques and the parameters are compared in this report. Also, the optimized antenna parameters, the theoretical designed antenna are compared in this

exercise. A novel technique of process optimization Taguchi Method was also studied in due course of time. This is also included in the report.

# Design and Development of Compact and Planar Sensor for Brix Measurement

By

Dipali Subhash Sonawane

121334015

Under the guidance of:

Dr.S.P.Mohani

## Abstract:

The parametric study contains the study of different techniques for optimizing the different parameters of antenna to get the optimum results and performance. This is a simulation based study. The design and simulation of the antenna is carried out using HFSS software. The design is elliptical monopole antenna with modified ground plane.

All the design antennas are fabricated on an inexpensive dielectric substrate FR-4 with relative permittivity ($\varepsilon_r$) of 4.4 with thickness of 1.6 mm. The return loss curve shows that the antenna has bandwidth from 4 GHz to 6.5 GHz with a minimum S11 -40 dB at 5.81 GHz. Return loss curve, antenna gains and the far field results are shown for all the designed antennas. Various results reflect the good antenna performance in the UWB range of frequency. Then the effects of varying the parameters of the antenna on its performance are investigated and shown.

# Design and Implementation of VHF Power amplifier for VLPT station

By
Parag Appasaheb Sonne
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Under the Guidance of
Mrs R. D. Joshi

This research work deals with the design and development of RF power amplifier block in Very Low Power Transmitter (VLPT) system. Challenges of this work were to design 50 W power amplifier for VLPT station covering the frequency band of 174-230 MHz (VHF) and keeping the performance of the power amplifier constant over all frequency channels. The RF power amplifier for VHF band is simulated on AWR microwave office circuit simulator. After verifying the results of the simulations the hardware is implemented. PCB layout is designed and simulated on CADsoft's Eagle simulator.

The research work presented in this thesis aims to achieve high-power, high-efficiency amplification across substantial bandwidths at microwave frequencies. The push-pull topology was identified as a promising possible solution which had previously not been considered for this application.

The key component in the push-pull power amplifier is the balun, which converts between balanced and unbalanced signal environments. The wide performance of the transmission line baluns opened up the possibility of realizing push-pull power amplifiers across similar bandwidths. Another power amplifier was designed to work as a driver for the push-pull configuration. It was operated in Class-A mode with distributed transmission line matching.

The viability of the push-pull amplifier topology was demonstrated through a prototype amplifier, which achieved high output power levels and efficiencies over a wide bandwidths. Measurement systems for characterizing and analysing these amplifiers were developed, which should lead to improved understanding and better performance in future.

A proper test setup was installed for the successful testing and tuning of the power amplifier and the results were compared with the desired specifications in this research work.

# DESIGN AND IMPLEMENTATION OF ANTENNA SYSTEM FOR VERY LOW POWER TV TRANSMITTER (VLPT)

By
KUMAR M. TRIMKHE
(121334017)
**Under the guidance of:**
Dr. R.D. JOSHI

## Abstract:

In certain regions, absence of transmissions on few channel band is observed. Very Low power transmitters are concerned with the use of such bands in VHF and UHF range. Since, this band provides sufficient bandwidth and range to cover a distinct area. Such transmitters can be established solely for community education and managed by existing schools as additional support for children and support for adult education in the area. VLPT proposes to use Software Defined Radio chip as base for developing a solution for this requirement with auxiliary objectives of making it compatible with data broadcasting, flexibility for meeting future standards of radio and TV transmissions as well as with low cost of materials used..

Goal of project is to develop an antenna system for VLPT, which is helpful of transmitting and receiving audio content and messages. It is assumed that an antenna is a passive reciprocal device and may be used either for transmission or reception of the electromagnetic energy. Antennas are employed in systems such as radio and television broadcasting, point-to-point radio communication, wireless LAN, radar, and space exploration. In this, it is desired to cover an area (20-40 KM) surrounded by nearby villages from projected antenna location. Yagi offers better gain with optimum beamwidth. Also, it is widely used for broadcast applications. Hence, proposed antenna model for this project is Yagi- Uda model.As these antennas offers features, such as low weight, high efficiency, high gain and better beamwidth.

Basic approach of this project is to design an antenna and with suitable improvements like better electric field intensity, directivity with suitable beamwidth etc. Then, placing such antennas in cascade, system can transmit on all channels (VHF, UHF Band) from base station. Antenna models are simulated using CAD-FEKO for particular frequencies providing optimum values of all parameters such as gain, beam width, impedance, reflection coefficient, VSWR etc. The antenna structures are fabricated with optimum resource utilization and finally practically obtained results are validated with simulated results.

# SNR Based Spectrum Sensing Scheme in Cognitive Radios

By
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## ABSTRACT

In the past few decades the need for high data rate wireless communication has experienced a booming growth indicating a huge commercial potential. The growing demand of wireless devices is restricted by the spectrum access policy of the radio regulatory regime. The larger part of the spectrum is allocated for exclusive use by the licensed users, and only a small portion of the spectrum is given for open access. The commercial success of the unlicensed spectrum has encouraged FCC to frame policies towards more flexible and open spectrum access.

Most of the licensed bands suffer from under-utilization and less spectral occupancy of the spectrum. The exclusive usage criteria in the licensed spectrum have resulted in wastage of the limited and precious spectrum. The so called ‘spectrum scarcity’ and ‘limited radio spectrum’ is a result of the way the spectrum is being regulated.

Cognitive radio has emerged as a solution to the problem of low spectral occupancy and inefficient utilization of the licensed radio spectrum. It enables the unlicensed users to access the licensed band without violating the exclusive usage facility for the licensed user. It identifies the unused portions of the licensed spectrum known as spectrum holes and makes them available for unlicensed or secondary users.

Spectrum sensing is a technique in which the surrounding radio environment is sensed in order to determine the presence or absence of the licensed user in the licensed band. It enables the CR to get an overview on the radio environment usage and in determining the spectrum holes.

In multi-antenna cooperative spectrum sensing with multiple PUs and multipath channel in low SNR regime a noise-uncertainty free detector is a optimal choice.A spectrum sensing scheme works optimally in low SNR regime with proper choice of test statistic is discussed here.From the considered simulation settings, performance gain over several known detection algorithms is observed in scenarios with relatively low signal to noise ratio.

# Effect of Carrier Frequency Offset in OFDM

By

Mrs.Parimal Sane

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Under the guidance of: Dr.S.P.Mohani

## ABSTRACT

Orthogonal frequency division multiplexing (OFDM) is a transmission method that can achieve high data rates by multicarrier modulation. In this modulation all sub-carriers are orthogonal to each other, which increase the bandwidth efficiency of the system. The project concept is to analyze the effect of the Carrier frequency offset (CFO) which affects the performance of OFDM system. CFO is a major contributor to the ICI (Inter Carrier interference) in OFDM system. ICI destroys the orthogonality between the subcarriers. Frequency synchronization in OFDM must be precise because of the narrowness of the subcarriers used. Basically to get a good performance of OFDM, the CFO should be estimated and compensated.

In this thesis, the effects of CFO on the SNR in an OFDM system are studied. CFO estimation algorithms are reviewed and discussed. The effect of modifications in the system parameters on estimating and compensating the effect of CFO is analyzed. Time and frequency domain estimation techniques are used in the investigation for CFO. For CFO estimation in time domain, cyclic prefix (CP) and training symbol are used. In CFO estimation using frequency domain pilot tones can be inserted in the frequency domain and transmitted in every OFDM symbol for CFO tracking. CFO in OFDM systems destroys the orthogonality among subcarriers and leads to significant performance degradation.