Amplitude Modulation

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Abstract — **In this paper I explain the most important modulation technique and I explain the type of this Technique (AM). Amplitude modulation (AM) reflectometry is a technique for density profile measurements in magnetic fusion plasmas based on the measurement of the phase delay of the modulation in the amplitude of a microwave beam launched and reflected at the plasma. Results from AM experiments in the PBX-M tokomak and the W7-AS stellarator are presented. A general analysis of the capabilities of the technique is performed, particularly centered in the effects of spatial turbulence. Simulations of the effects of two-dimensional turbulence have been performed for medium size (W7-AS) and large devices (LHD stellarator, ITER), showing the capability of the AM technique to operate in turbulent plasmas. Finally, possible solutions to the problem of parasitic reflections in AM systems are presented as development options.**
Keywords — **amplitude modulation.**

I. INTRODUCTION

Modulation is a process in which allow information signal changes on of the parameters (Amplitude, Frequency and phase).and we can say it is a process to shift the signal from low frequency into high frequency signal. We can modulate the information signal by use the carrier signal. Amplitude modulation (AM) is a technique used in electronic communication, most commonly for transmitting information via a radio carrier wave. AM works by varying the strength of the transmitted signal in relation to the information being sent. For example, changes in the signal strength can be used to specify the sounds to be reproduced by a loudspeaker, or the light intensity of television pixels. (Contrast this with frequency modulation, also commonly used for sound transmissions, in which the frequency is varied; and phase modulation, often used in remote controls, in which the phase is varied). In the mid-1870s, a form of amplitude modulation—initially called "adulatory currents"—was the first method to successfully produce quality audio over telephone lines. Beginning with Reginald Fessenden's audio demonstrations in 1906, it was also the original method used for audio radio transmissions, and remains in use today by many forms of communication—"AM" is often used to refer to the medium wave broadcast band (see AM radio).

AM was the dominant method of broadcasting during the first eighty years of the 20th century and remains widely used into the 21st. AM radio began with the first, experimental broadcast on Christmas Eve of 1906 by Canadian experimenter Reginald Fessenden, and was used for small-scale voice and music broadcasts up until World War I. San Francisco, California radio station KCBS claims to be the direct descendant of KQW, founded by radio experimenter Charles "Doc" Harold, who made regular weekly broadcasts in San Jose, California as early as June 1909. On that basis KCBS has claimed to be the world's oldest broadcast station and celebrated its 100th anniversary in the summer of 2009. The great increase in the use of AM radio came late in the following decade as radio experimentation increased worldwide following World War I. The first licensed commercial radio services began on AM in the 1920s. XWA of Montreal, Quebec (later CFCF, now CINW) claims status as the first commercial broadcaster in the world, with regular broadcasts commencing on May 20, 1920. The first licensed American radio station was started by Frank Conrad, KDKA in Pittsburgh, Pennsylvania. Radio programming boomed during the "Golden Age of Radio" (1920s–1950s). Dramas, comedy and all other forms of entertainment were produced, as well as broadcasts of news and music. There are three parameters for any signal:

1-amplitude
2-frequency
3-phase

$$c(t) = C \cdot \sin(\omega_c t + \phi_c), \qquad \text{.............1}$$

Amplitude Modulator

It is an analogue modulation technique in which that amplitude of the carrier varies proportional to the information signal.

Now we can discuss the type of amplitude modulation:

1-double sideband transmitted carrier.
2-double sideband suppressed carrier.
3-single sideband.
4-vestigal sideband.
5-quadrature AM.

Modulation is the process of varying one or more properties of a high-frequency periodic waveform, called the carrier signal, with a modulating signal which typically contains information to be transmitted. This is done in a similar fashion to a musician modulating a tone (a periodic waveform) from a musical instrument by varying its volume, timing and pitch. The three key parameters of a periodic waveform are its amplitude ("volume"), its phase ("timing") and its frequency ("pitch"). Any of these properties can be modified in accordance with a low frequency signal to obtain the modulated signal. Typically a high-frequency sinusoid waveform is used as carrier signal, but a square wave pulse train may also be used. In telecommunications, modulation is the process of conveying a message signal, for example a digital bit stream or an analog audio signal, inside another signal that can be physically transmitted. Modulation of a sine waveform is used to transform a baseband message signal into a pass band signal, for example low-frequency audio signal into a radio-frequency signal (RF signal). In radio communications, cable TV systems or the public switched telephone network for instance, electrical signals can only be transferred over a limited pass band frequency spectrum, with specific (non-zero) lower and upper cutoff frequencies. Modulating a sine-wave carrier makes it possible to keep the frequency content of the transferred signal as close as possible to the centre frequency (typically the carrier frequency) of the pass band. The term digital baseband modulation (or digital baseband transmission) is synonymous to line codes. These are methods to transfer a digital bit stream over an analog baseband channel (a.k.a. low pass channel) using a pulse train, i.e. a discrete number of signal levels, by directly modulating the voltage or current on a cable. Common examples are unipolar, non-return-to-zero (NRZ), Manchester and alternate mark inversion (AMI) codings.

I. DOUBLE SIDEBAND TRANSMITTED CARRIER:

The modulation process shifts frequencies from a band around DC to a band around the carrier frequency. This Permits efficient transmission and also allows simultaneous transmission of more than one baseband signal. In this experiment you explore a modification of AM in which we add a portion of the pure sinusoidal carrier to the modulated waveform you will see that this addition greatly simplifies the demodulation process Figure 1 shows the addition of a pure sinusoidal carrier to the double-sideband suppressed carrier waveform.

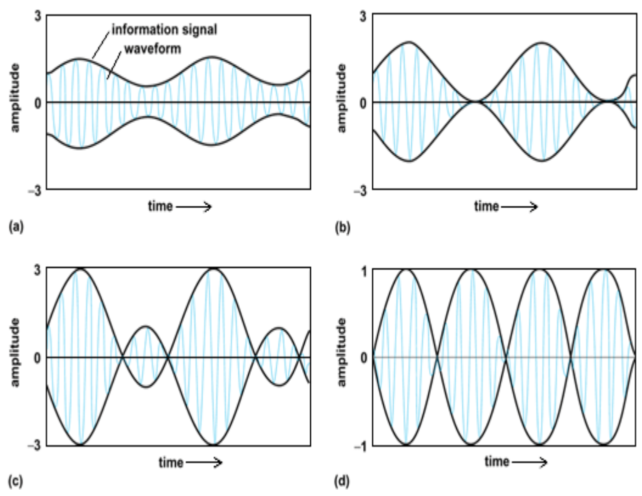

Figure 1. the general formula for double sideband transmitted carrier

$$s(t) = \cos 2\pi f_c t + n_a \cos 2\pi f_c t \cos 2\pi f_m t \quad \ldots\ldots 2$$

A carrier wave is modeled as a simple sine wave, such as:

$$c(t) = C \cdot \sin(\omega_c t + \phi_c),$$

where the radio frequency (in Hz) is given by:

$$\omega_c / (2\pi).$$

The constants C and ϕ_c represent the carrier amplitude and initial phase, and are introduced for generality. For simplicity however, their respective values can be set to 1 and 0.

Let m(t) represent an arbitrary waveform that is the message to be transmitted. And let the constant M represent its largest magnitude.

II. DOUBLE SIDEBAND SUPPRESSED CARRIER:

It is an AM in which two sideband are transmitted and the carrier is suppressed; the following figure 2 is shown the (DSBSC) and the general expression shown in this figure.

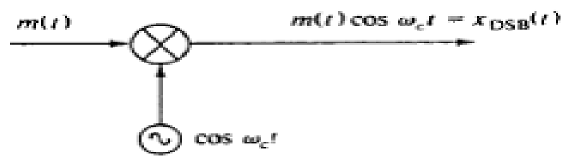

Figure 2. Double sideband suppressed carrier. And the following figure is appeared the waveform of the (DSCSC)

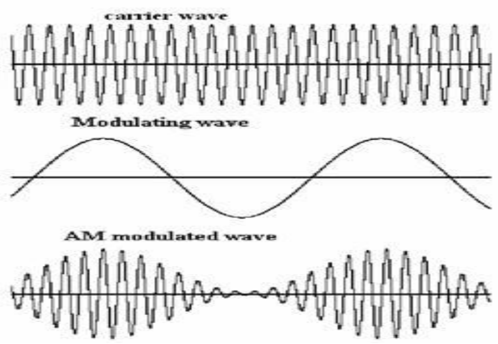

Figure 3. single sideband.

III. SINGLE SIDEBAND

It is a modulation technique in which one sideband is transmitted and other suppressed .and SSB was also used over long distance telephone lines.

We use the single sideband for save the power and the bandwidth.

It is a modulation technique in which one sideband is transmitted partially of the other sideband is suppressed, we use this type in TV technology and telephone technology.

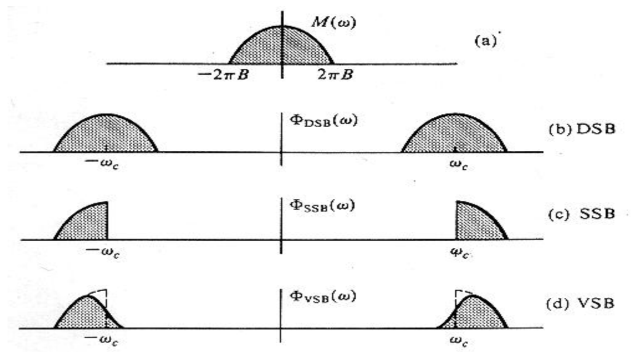

Figure 5. shown the waveform of vestigial sideband:

IV. QUADRATURE AMPLITUDE

It is the technique uses to transmitted two different signals on the same carrier frequency but these will not interference, we use this type to transmit color signal TV

TABLE I. FIGURE AND EQUATIO:

equation 1	An example for carrier signal
Figure 1	waveform for DSBTC
equation 2	the general formula for DSBSC
Figure 2	the (DSBSC)
Figure3	waveform of the (DSCSC)
Figure4	The waveform of single sideband is shown in figure 4
Figure5	waveform of vestigial sideband

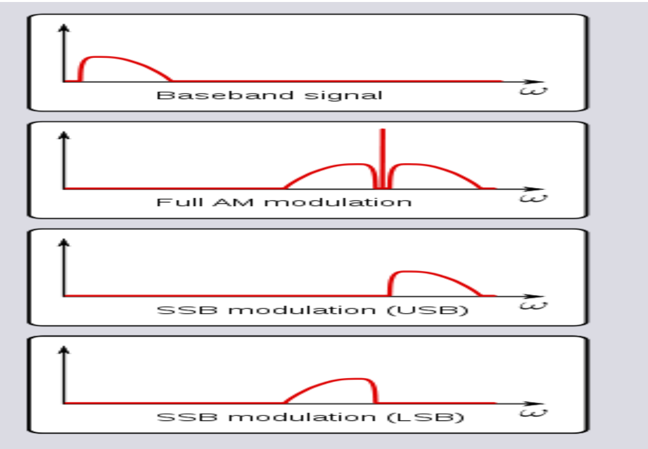

Figure 4. The waveform of single sideband

Forms of amplitude modulation, in radio communication, a continuous wave radio-frequency signal (a sinusoidal carrier wave) has its amplitude modulated by an audio waveform before being transmitted. In the frequency domain, amplitude modulation produces a signal with power concentrated at the carrier frequency and in two adjacent sidebands. Each sideband is equal in bandwidth to that of the modulating signal and is a mirror image of the other. Amplitude modulation that results in two sidebands and a carrier is often called double-sideband amplitude modulation (DSB-AM). Amplitude modulation is inefficient in terms of power usage. At least two-thirds of the power is concentrated in the carrier signal, which carries no useful information (beyond the fact that a signal is present).

To increase transmitter efficiency, the carrier can be removed (suppressed) from the AM signal. This produces a reduced-carrier transmission or double-sideband suppressed-carrier (DSBSC) signal. A suppressed-carrier amplitude modulation scheme is three times more power-efficient than traditional DSB-AM. If the carrier is only partially suppressed, a double-sideband reduced-carrier (DSBRC) signal results. DSBSC and DSBRC signals need their carrier to be regenerated (by a beat frequency oscillator, for instance) to be demodulated using conventional techniques.

Improved bandwidth efficiency is achieved—at the expense of increased transmitter and receiver complexity—by completely suppressing both the carrier and one of the sidebands. This is single-sideband modulation, widely used in amateur radio due to its efficient use of both power and bandwidth.

A simple form of AM often used for digital communications is on-off keying, a type of amplitude-shift keying by which binary data is represented as the presence or absence of a carrier wave. This is commonly used at radio frequencies to transmit Morse code, referred to as continuous wave (CW) operation.

V. CONCLUSION

We use the AM modulation to prevent the interference and to propagate the low frequency for long distance and to meet equipment limitation. And we use the single sideband to save power and bandwidth.

REFERENCES

[1] Modern electronic communication, Gary M. Miller, 3rd edition.
[2] Introduction to communication system, third edition, Ferrel g stremler.
[3] Radio System Design for Telecommunication, 3rd Edition.
[4] An introduction to analog and digital communication, Simon Havkin, second edition.
[5] http://en.wikipedia.org/wiki/Amplitude_modulation.
[6] http://www.standrews.ac.uk/~www_pa/Scots_Guide/RadCom/part9/page1.html
[7] Silver, Ward, ed (2011). "Ch. 15 DSP and Software Radio Design". The ARRL Handbook for Radio Communications (Eighty-eighth ed.). American Radio Relay League. ISBN 978-0-87259-096-0.
[8] Newkirk, David and Karlquist, Rick (2004). Mixers, modulators and demodulators. In D. G. Reed (ed.), The ARRL Handbook for Radio Communications (81st ed.), pp. 15.1–15.36. Newington: ARRL. ISBN 0-87259-196-4.