PARAMETRIC AMPLIFIERS:

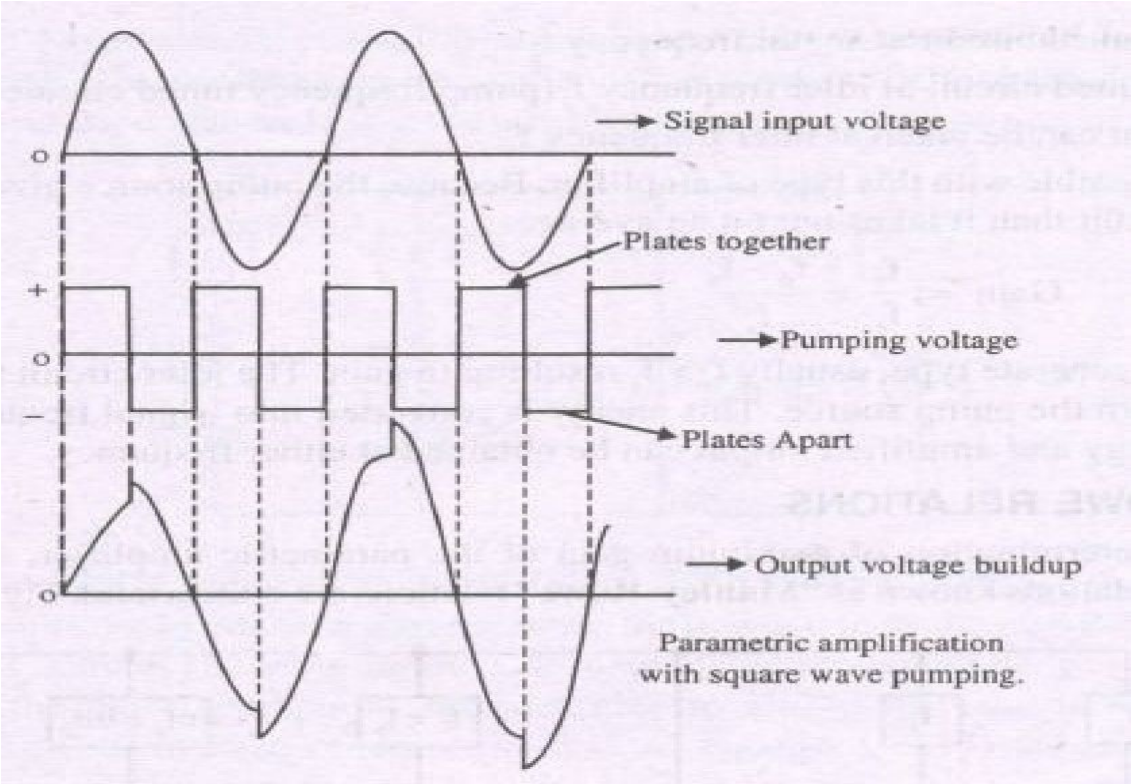
The parametric amplifier is an amplifier using a device whose reactance is varied to produce amplification. Varactor diode is the most widely used active element in a parametric amplifier. It is a low noise amplifier because no resistance is involved in the amplifying process. There will be no thermal noise, as the active element used involved is reactive (capacitive). Amplification is obtained if the reactance is varied electronically in some predetermined fashion.

Due to the advantage of low noise amplification, parametric amplifiers are extensively used in systems such as long range radars, satellite ground stations, radio telescopes, artificial satellites, microwave ground communication stations, radio astronomy etc.

Basic **Parametric Amplifier**

A conventional amplifier uses a variable resistance and a d.c. power supply. For a parametric amplifier, a variable reactance and an ac power supply are needed.

Pumping signal at frequency fp and a small amplitude signal at frequency fs are applied simultaneously to the device (varactor). The pump source supplies energy to the signal (at the signal frequency) resulting in amplification. This occurs at the active device where the capacitive reactance varies at the pump frequency.



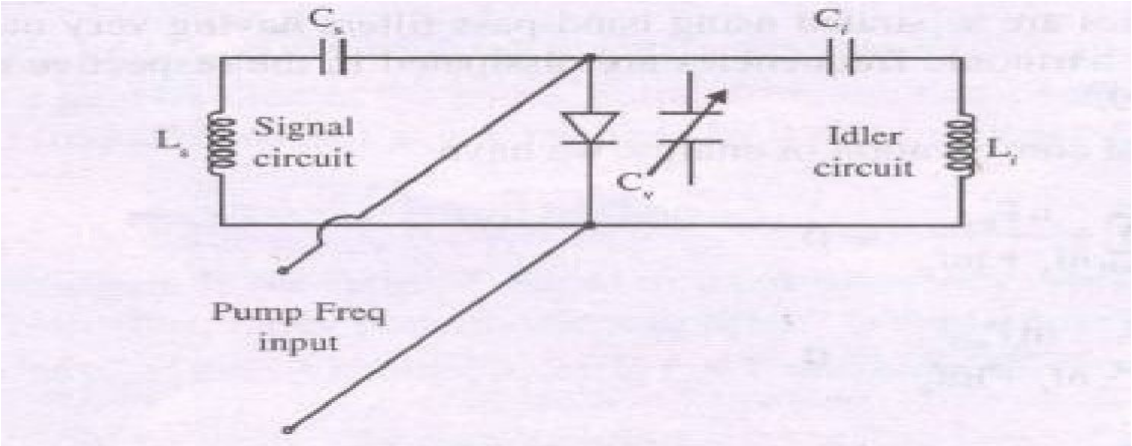
The voltage across the varactor is increased by the pumping signal at each signal voltage peak as shown above i.e., energy is taken from the pump source and added to the signal at the signal frequency. With an input circuit and load connected, amplification results.

One port non-degenerate amplifier is the most commonly used parametric amplifier. Only three frequencies are involved - the pump, the signal and the idler

frequencies. If pump frequency is fp' the signal frequency is fs' then idler frequency is fj = fp - fs'

If fi = fs' then it is called Degenerate amplifier and

if fi is not equal to fs' then it is non-degenerate amplifier.



Ls Cs ~ tuned circuit at signal frequency fs

Lj Cj ~ tuned circuit at idler frequency fj (pump frequency tuned circuit is not shown),

The output can be taken at idler frequency fr Gain is possible with this type of amplifier. Because the pump source gives more energy

$$\text{Gain} = \frac{f_j}{f_s} = \frac{f_p - f_s}{f_s}$$

In non-degenerate type, usually fj > fs resulting in gain. The idler circuit permits energy to be taken from the pump source. This energy is converted into signal frequency and idler frequency energy and amplified output can be obtained at either frequency.

Source : http://elearningatria.files.wordpress.com/2013/10/ece-v-microwaves-and-radar-10ec54-notes.pdf