Frequency Multiplier

Frequency multipliers use circuits tuned to a harmonic of the input frequency. Non-linear elements such as diodes may be added to enhance the production of harmonic frequencies. Since the power in the harmonics declines rapidly, usually a frequency multiplier is tuned to only a small multiple (twice, three times, or five times) of the input frequency. Usually amplifiers are inserted in a chain of frequency multipliers to ensure adequate signal level at the final frequency.

Step recovery diodes produce harmonics with power dropping at the rate of 1/N. Such diodes can often be found in frequency multiplier circuits.

Since the tuned circuits have a limited bandwidth, if the base frequency is changed significantly (more than one percent or so), the multiplier stages may have to be adjusted; this can take significant time if there are many stages.

In digital electronics, frequency multipliers are often used along with frequency dividers and phase-locked loops to generate any desired frequency from an external reference frequency. The frequency multiplication is actually carried out quite cleverly in the phase-locked loop's feedback loop, by using a frequency divider on the output of the voltage controlled oscillator (VCO). This divided-down output is fed-back to the input comparator and compared to the reference frequency.

Since the divided down frequency is smaller than the reference frequency, the comparator generates a voltage signal to the VCO, telling it to increase the output frequency. It continues to do this via the feedback loop, raising the VCO output frequency, until the divided-down frequency from the VCO output is equal to the reference frequency. At this point the comparator stabilizes and generates no more signals to the VCO, or only minor changes to maintain stability. The output frequency from the VCO will be stable at the input reference frequency multiplied by the value of the feedback divider.

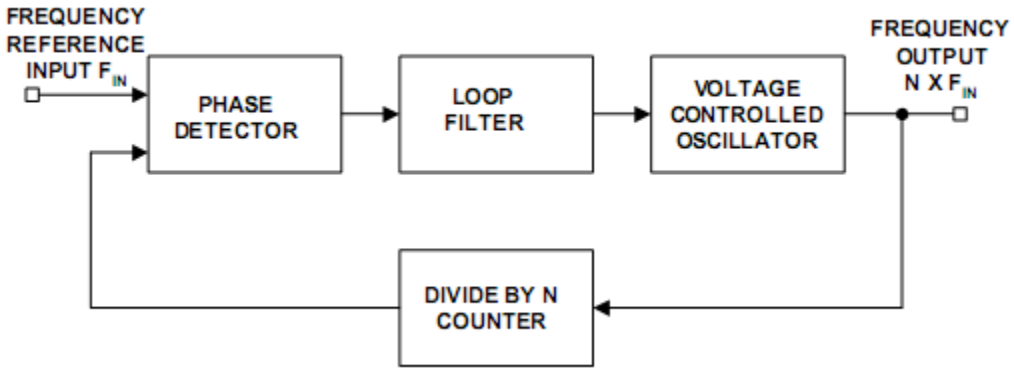

Figure 4.9

Phase Locked Loops (PLL) circuits are used for frequency control. They can be configured as frequency multipliers, demodulators, tracking generators or clock recovery circuits. Each of these applications demands different characteristics but they all use the same basic circuit concept.