Pulse Position Modulation

Pulse Position Modulation (PPM) is an analog modulating scheme in which the amplitude and width of the pulses are kept constant, while the position of each pulse, with reference to the position of a reference pulse varies according to the instantaneous sampled value of the message signal. The transmitter has to send synchronizing pulses (or simply sync pulses) to keep the transmitter and receiver in synchronism. These sync pulses help maintain the position of the pulses. The following figures explain the Pulse Position Modulation.

Pulse position modulation is done in accordance with the pulse width modulated signal. Each trailing of the pulse width modulated signal becomes the starting point for pulses in PPM signal. Hence, the position of these pulses is proportional to the width of the PWM pulses. In PPM, the amplitude and width of the pulses is kept constant but the position of each pulse is varied in accordance with the amplitudes of the sampled values of the modulating signal. The position of the pulses is changed with respect to the position of reference pulses. The PPM pulses can be derived from the PWM pulses as shown in fig.5.4.1. Here, it may be noted that with increase in the modulating voltage the PPM pulses shift further with respect to reference. Figure 5.4.2 (a) and . Figure 5.4.2 (b) shows Constant Amplitude Periodic Pulse Train and Pulse Position Modulated Signal.

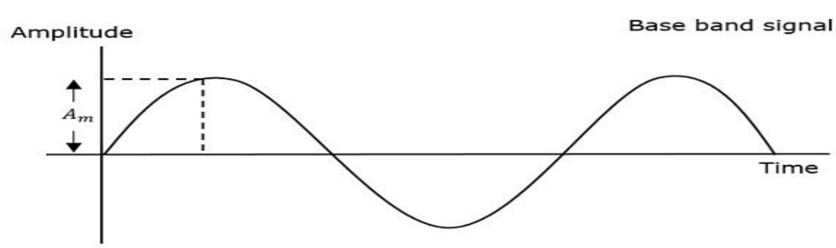

Figure 5.4.1 Base band Signal or Modulating Signal

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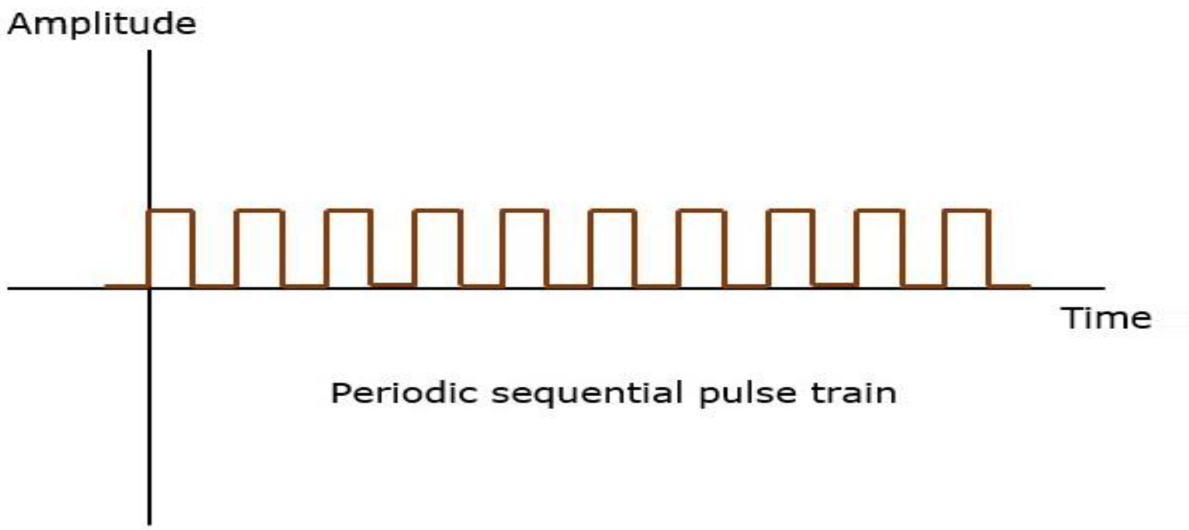

Figure 5.4.2 (a) Constant Amplitude Periodic Pulse Train

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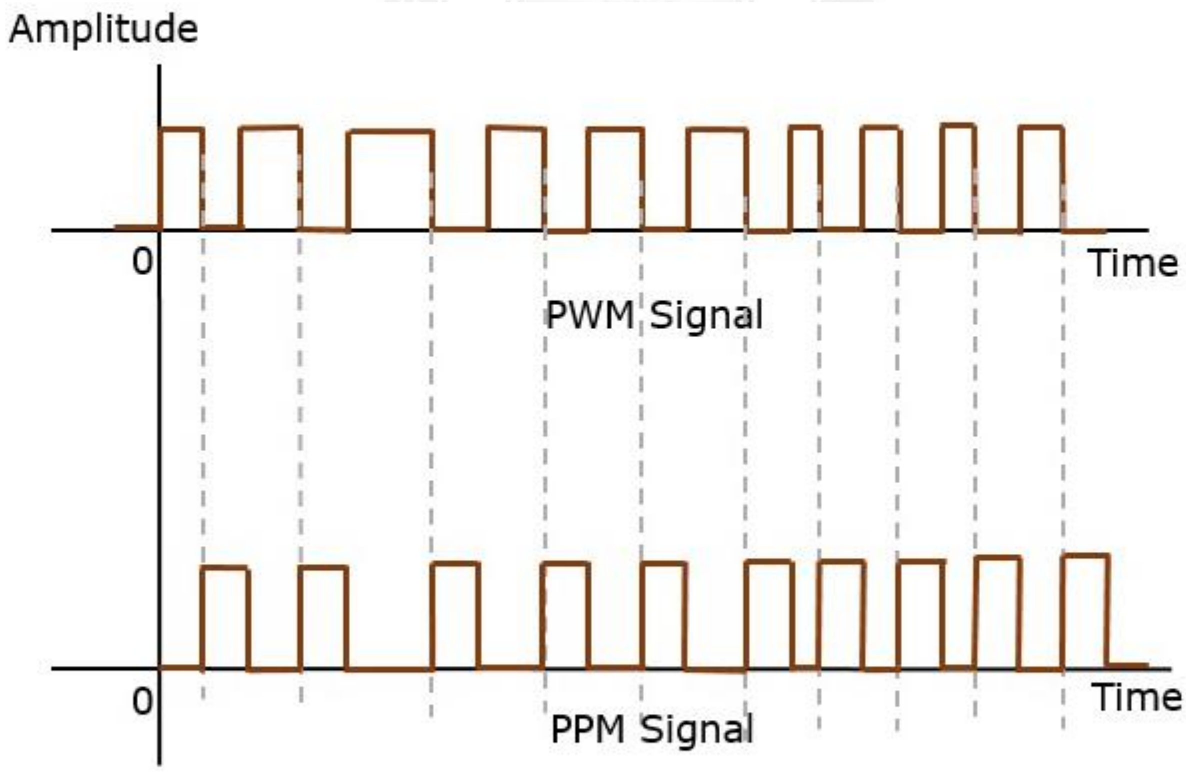

Figure 5.4.3 (b) Pulse Position Modulated Signal

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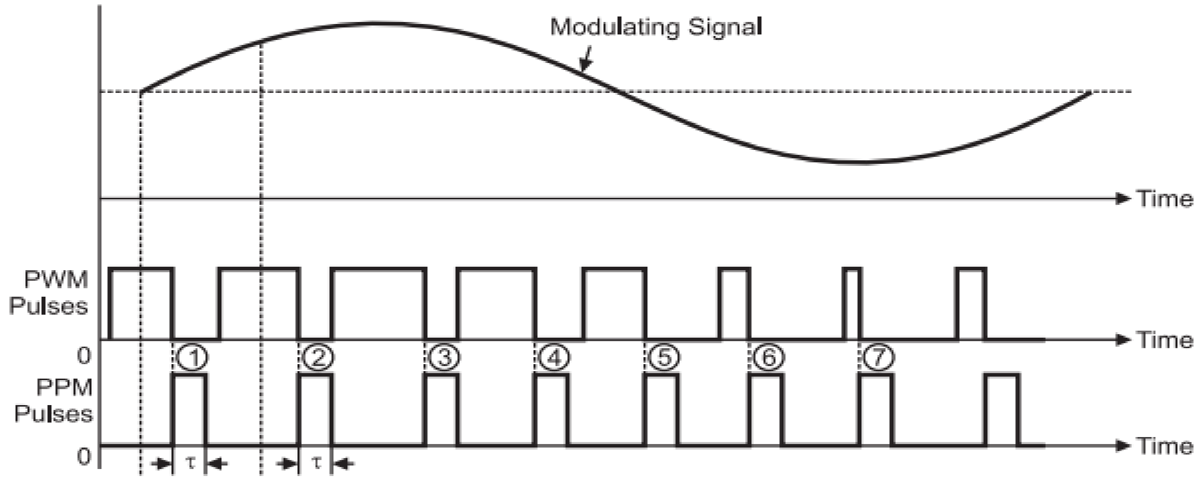

Figure 5.4.4 PPM pulses generated from PWM signal

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The vertical dotted lines drawn in fig.1 are treated as reference lines to measure the shift in position of PPM pulses. The PPM pulses marked 1, 2 and 3 in fig.5.4.3 go away from their respective reference lines. This is corresponding to increase in the modulating signal amplitude. Then, as the modulating voltage decreases, the PPM pulses 4, 5, 6, 7 come progressively closer to their respective reference lines.

Generation of PPM Signal

The PPM signal can be generated from PWM signal as shown in fig.5.4.4 (a).

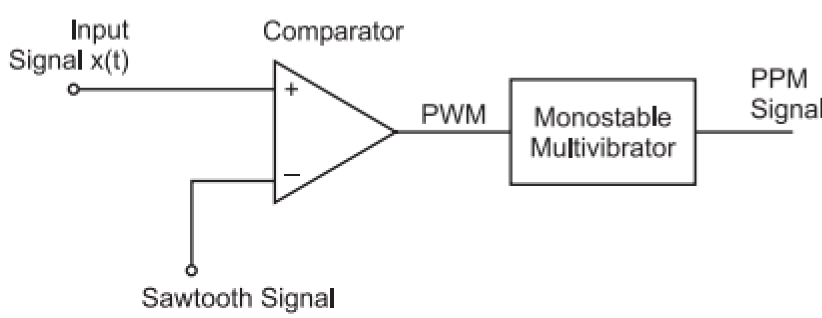

Figure 5.4.5 Generation of PPM signal

Diagram Source Brain Kart

The PWM pulses obtained at the comparator output are applied to a monostable multivibrator. The monostable is negative edge triggered. Hence, corresponding to each trailing edge of PWM signal, the monostable output goes high. It remains high for a fixed time decided by its own RC components. Thus, as the trailing edges of the PWM signal keep shifting in proportion with the modulating signal x(t), the PPM pulses also keep shifting, as shown in fig.5.4.5.

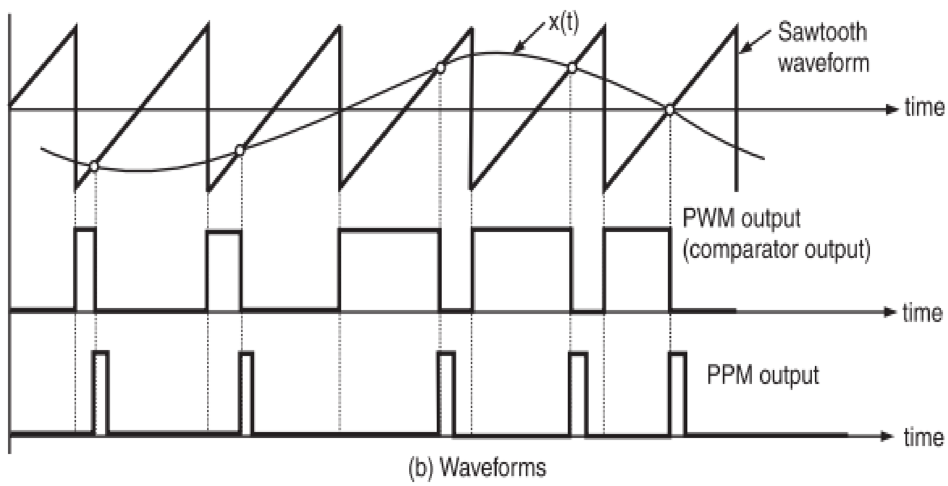

Figure 5.4.6 PPM from PWM Wave Forms

Diagram Source Brain Kart

Demodulation of PPM Signal

The PPM demodulator block diagram has been shown in fig.5.4.6

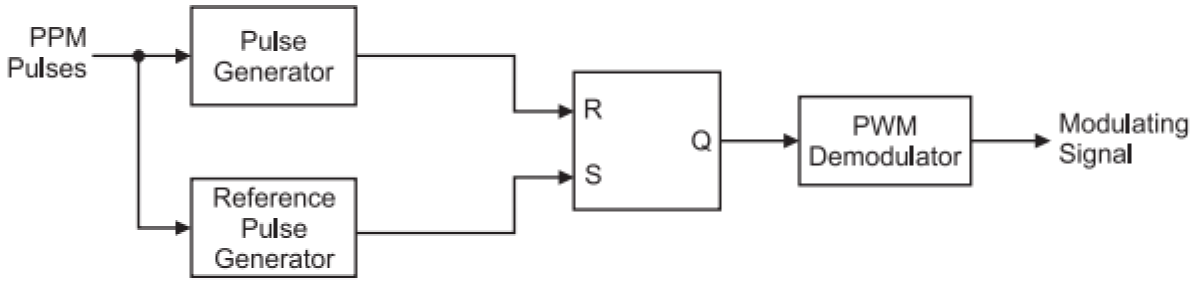

Figure 5.4.7 PPM Demodulator

Diagram Source Brain Kart

The operation of the demodulator circuit may be explained as under: The noise corrupted PPM waveform is received by the PPM demodulator circuit. The pulse generator develops a pulsed waveform at its output of fixed duration and applies these pulses to the reset pin (R) of a SR flip-flop. A fixed period reference pulse is generated from the incoming PPM waveform and the SR flip-flop is set by the reference pulses. Due to the set and reset signals applied to the flip-flop, we get a PWM signal at its output. The PWM signal can be demodulated using the PWM demodulator.

Advantage

As the amplitude and width are constant, the power handled is also constant.

Disadvantage

The synchronization between transmitter and receiver is a must.