2.2 Bipolar and Unipolar Pulse Width Modulation

Bipolar Pulse Width Modulation (PWM) generates dual-polarity voltage pulses, switching between positive and negative, while Unipolar PWM generates single-polarity pulses, switching between positive and zero.

Bipolar PWM:

Output: Generates dual-polarity voltage pulses, switching between positive and negative DC voltage levels.

Switching: Requires switching between positive and negative half-cycles of the output waveform, leading to potential increased switching losses.

Complexity: Typically requires more complex control circuitry.

Harmonics: May generate more harmonic distortion compared to unipolar PWM.

Unipolar PWM:

Output:

Generates single-polarity voltage pulses, switching between positive and zero DC voltage levels.

Switching:

Switching occurs only in one polarity, potentially leading to lower switching losses compared to bipolar PWM.

Complexity:

May require simpler control circuitry compared to bipolar PWM.

Harmonics:

Can reduce harmonic distortion in the output waveform compared to other modulation techniques, though may still have higher THD than more advanced PWM methods.

Applications:

Used in various applications like

- Motor speed control,
- Inverter/converter systems, and more.

The main difference between unipolar and bipolar Pulse Width Modulation (PWM) inverters lies in the way they generate the output voltage waveform and how they modulate the signals. Here's a detailed comparison:

Unipolar PWM Inverter

1. **Output Waveform**:
   - The output voltage alternates between zero and positive or zero and negative values, but never both at the same time.
   - Typically, it uses two switching devices for each half of the waveform (positive and negative).
2. **Switching Strategy**:
   - In a unipolar PWM scheme, the output switches between the positive and ground (0V) for the positive half

Unipolar PWM:

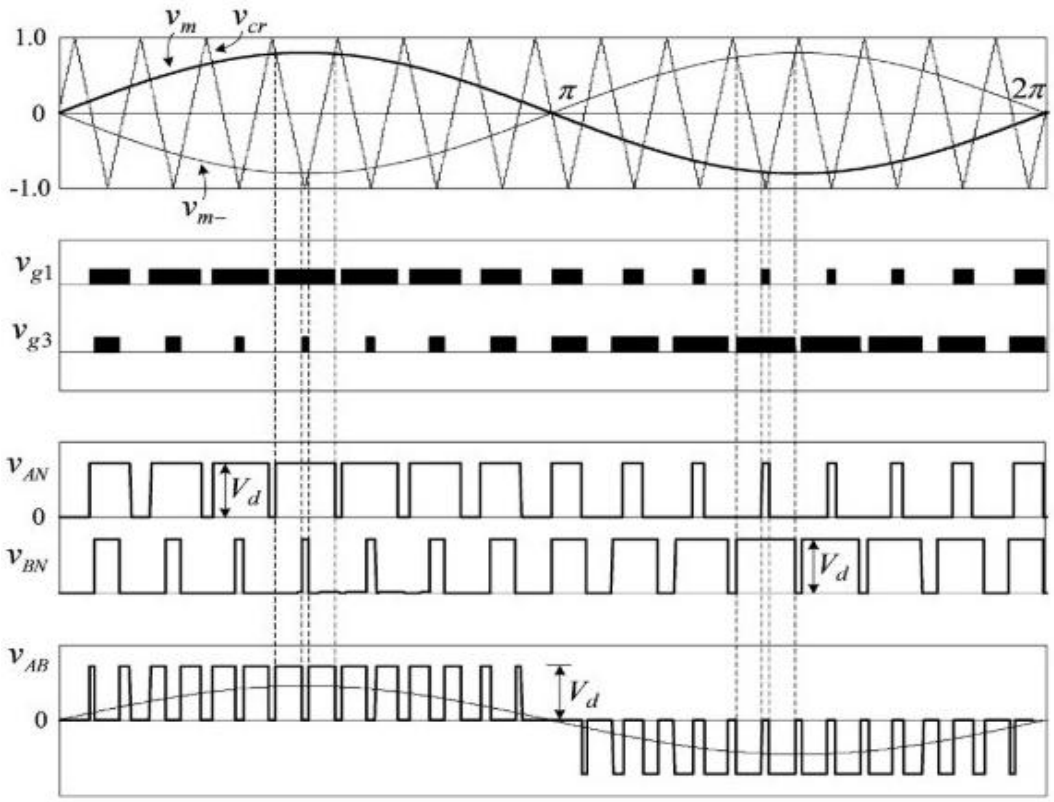

Figure 2.2.1 Unipolar PWM Wave form

[Source: "Power Electronics Circuits, Devices and Applications" by M.H. Rashid, Page: 267]

1. Three voltage levels are there in the output
2. It requires two 180 degree phase shifted sine waves as modulating waves
3. It is complicated to implement

Bipolar PWM:

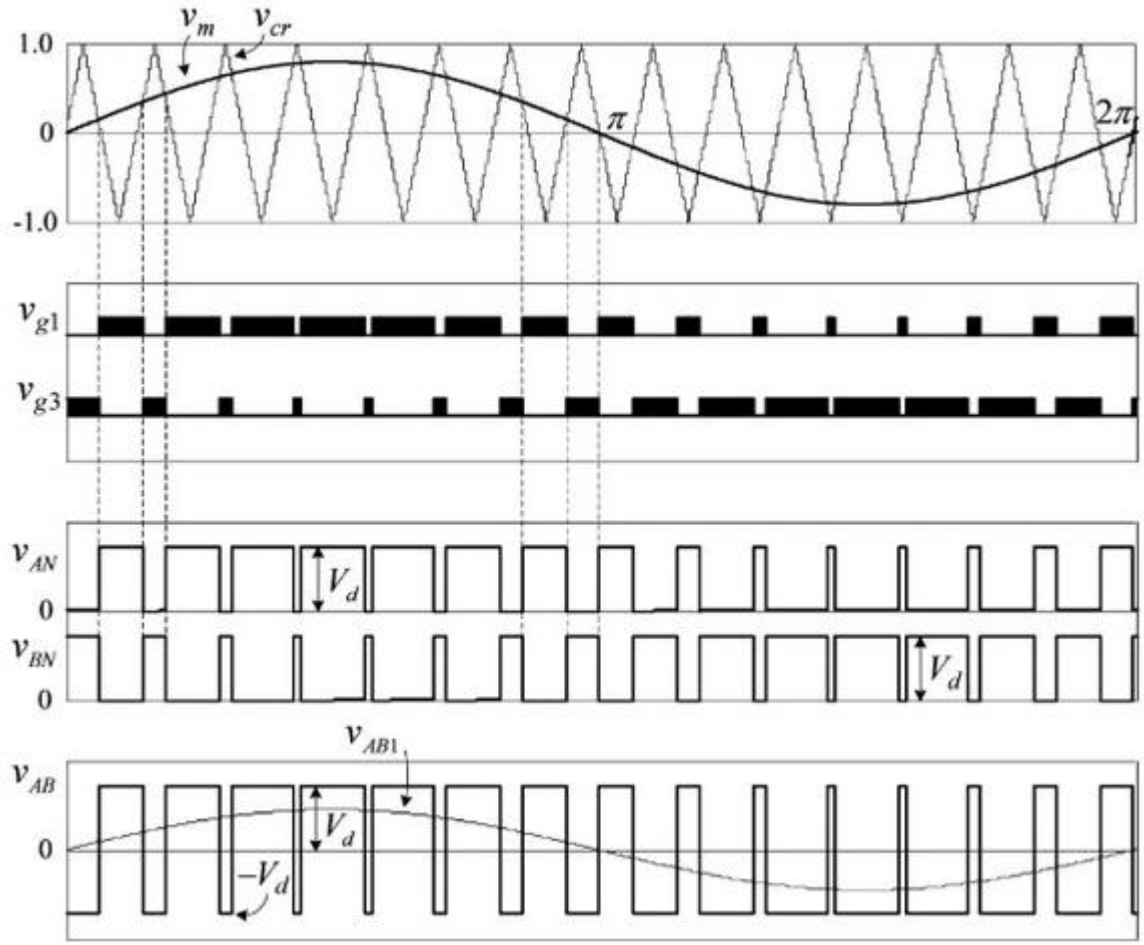

Figure 2.2.1 Bipolar PWM Wave form

[Source: "Power Electronics Circuits, Devices and Applications" by M.H. Rashid, Page: 267]

Only two voltage levels are there in the output **x** It requires only one sinewave

It is easier to implement The harmonic performance is poor.