Electronic Second Stage

MSc. Zahraa Niema Kamal Lecture Six First Course

Lecture Six

Full Wave Rectifier

1. Sinusoidal Input (Bridge Network)

The dc level obtained from a sinusoidal input can be improved 100% using a process called **Full-Wave Rectification**. The most familiar network for performing such a function appears in Fig. (20) with its four diodes in a bridge configuration. During the period t = 0 to T/2 the polarity of the input is as shown in Fig. (21). The resulting polarities across the ideal diodes are also shown in Fig. (21) to reveal that D2 and D3 are conducting while D1 and D4 are in the “off” state. The net result is the configuration of Fig. (22), with its indicated current and polarity across R. Since the diodes are ideal the load voltage is $V_o = V_i$, as shown in the same figure.

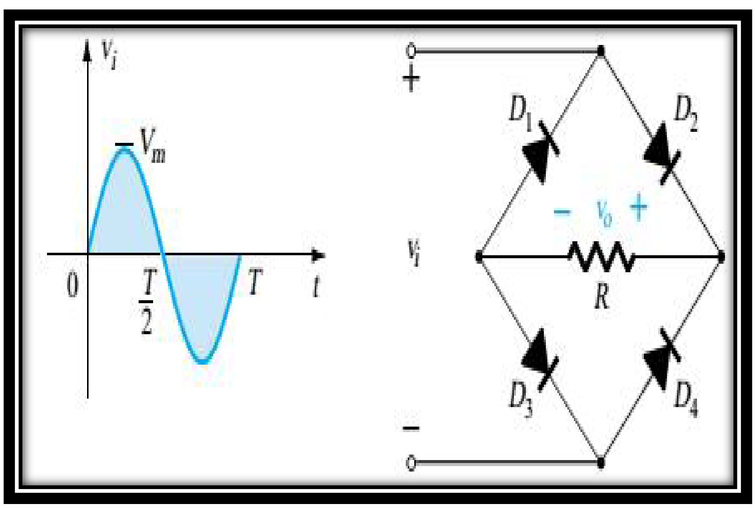

Figure (20) Full-Wave Bridge Rectifier

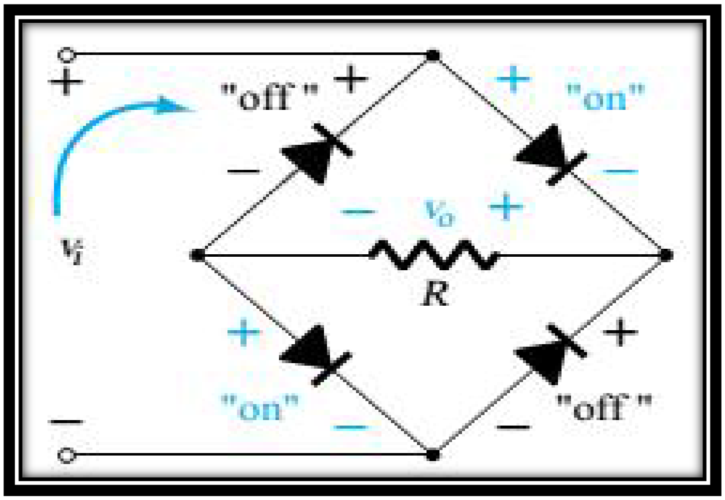

Figure (21) Network of Fig. (20) for the period 0 → T/2 of the input voltage Vi

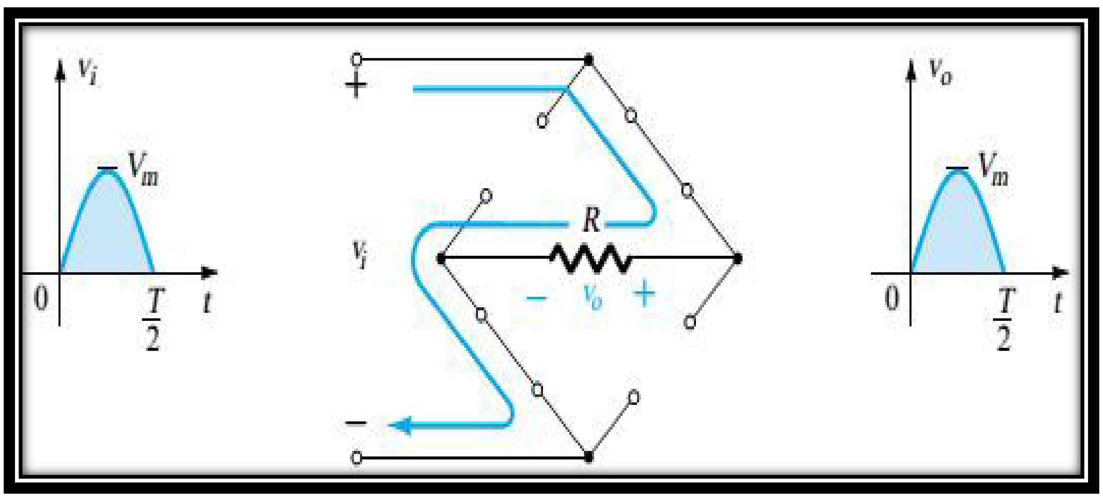

Figure (22) Conduction path for the positive region of Vi

For the negative region of the input the conducting diodes are D1 and D4, resulting in the configuration of Fig. (23). The important result is that the polarity across the load resistor **R** is the same as in Fig. (20), establishing a second positive pulse, as shown in Fig. (23). Over one full cycle the input and output voltages will appear as shown in Fig. (24)

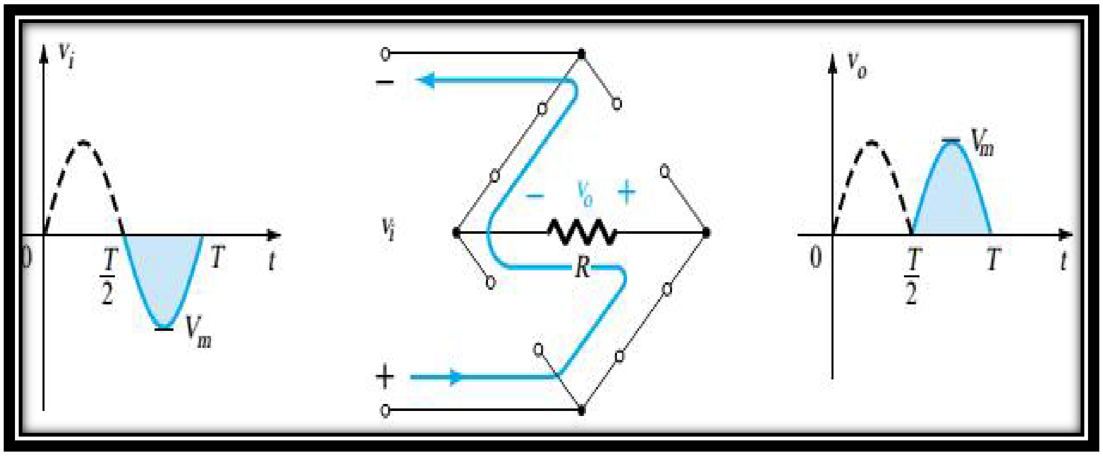

Figure (23) Conduction Path for the Negative Region of Vi

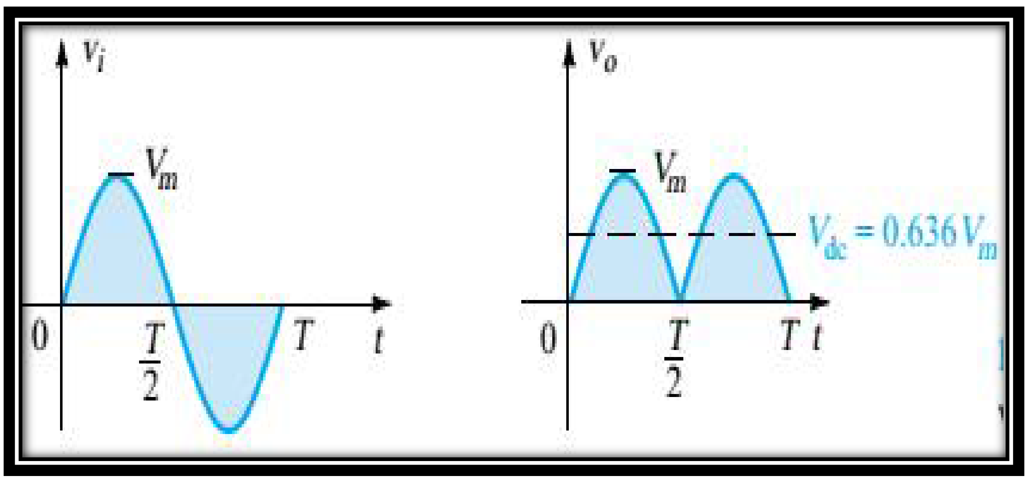

Figure (24) Input and Output Waveforms for Full-Wave Rectifier

Since the area above the axis for one full cycle is now twice that obtained for a half-wave system, the dc level has also been doubled and

$$V_{dc} = 0.636\ Vm \text{ (full-wave)}$$

If silicon rather than ideal diodes is employed as shown in Fig. (25), an application of Kirchhoff's voltage law around the conduction path would result in:

$$v_i - V_T - v_o - V_T = 0$$

and

$$v_o = v_i - 2V_T$$

The peak value of the output voltage v_o is therefore

$$V_{o_{max}} = V_m - 2V_T$$

For situations where Vm >> 2VT, then we can be applied for the average value with a relatively high level of accuracy.

$$V_{dc} \cong 0.636(V_m - 2V_T)$$

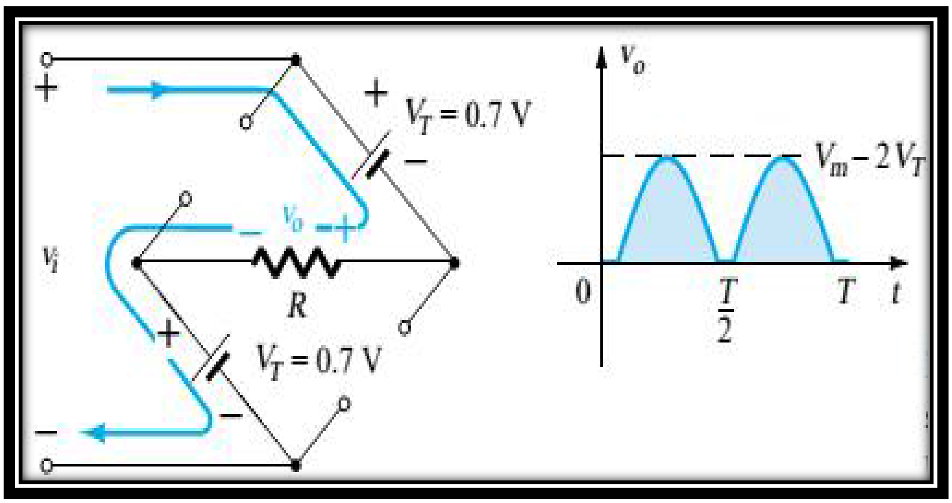

Figure (25) Determining Vo max For Silicon Diodes in the Bridge Configuration

Then again, if V_m is sufficiently greater than $2V_T$, then ($V_{dc} = 0.636V_m$) is often applied as a first approximation for V_{dc}.