INVERTER

The DC to AC power converters are known as Inverters. An inverter is a circuit, which converts a dc power into an ac power at desired output voltage and frequency. The ac output voltage could be fixed or variable frequency. This conversion can be achieved either by controlled turn on and turn off devices (e.g. BJT's, MOSFETs, IGBTs, MCTs, SITs, GTOs, and SITHs) or by forced commutated thyristors, depending on applications. The output voltage waveforms of ideal inverter should be sinusoidal. The voltage waveforms of practical inverters are, however, nonsinusoidal and contain certain harmonics. Square wave or quasi-square wave voltages are acceptable for low and medium power applications, and for high power applications low, distorted, sinusoidal waveforms are required. The output frequency of the inverter is determined by the rate at which the semiconductor devices are switched on and off by the inverter control circuitry and consequently, an adjustable frequency ac output is readily provided.

Single Phase Bridge Inverter: Single phase bridge inverter which needs four SCR and four freewheeling diodes. The sequence of SCR gating and the output waveforms are shown in figure T_1 and T_2 must be gated simultaneously and T_3 and T_4 must be gated 180_0 out of phase. When SCR_1 and SCR $_4$ conduct, the output voltage will be positive E_{DC} and when SCR_2 and SCR_3 conduct, the output voltage will be negative -E_{DC} as shown in figure Diodes D_1 to D_4 serve to feed the load reactive power back to the DC supply. The load voltage waveform is fairly rectangular and is not affected by the nature of the load. This is an advantage of bridge inverter over the series inverter .The circuit model of single phase bridge inverter is shown in figure

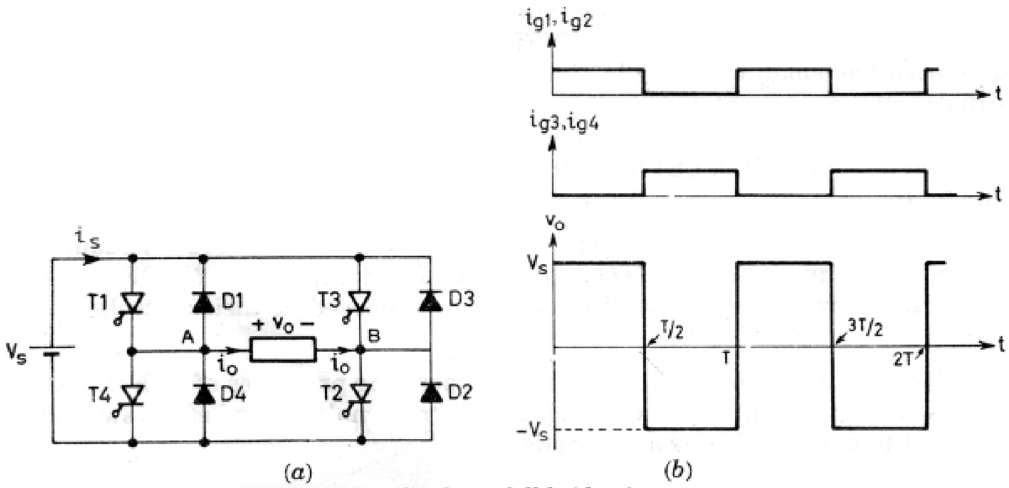
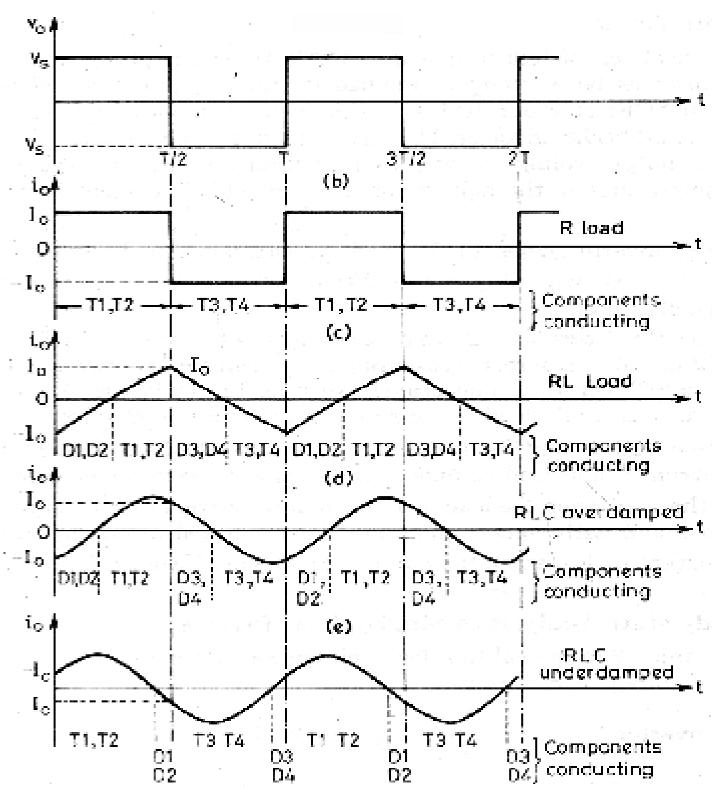


Figure 1
Single –phase full-bridge inverter

For a resistive load, load current i_o and load voltage V_o would always be in phase with each other. This however, is not the case when the load is the other than resistive .for such types of load io will not be in phase with voltage V_o and diodes connected in antiparallal with SCRs will allow the current to flow when the main SCRs are turned off .These diodes are called feedback diodes.

R Load: For resistive load R**,** load current waveform i_0 is identical with load voltage waveform V_0 and diodes D_1-D_4 do not come into conduction.

RL and RLC Overdamped Load: The load current waveforms for RL and RLC overdamped loads are shown in figures. Before t = 0, SCR T_3, T_4 are conducting and load current i_0 is flowing from B to A, i.e. in the reversed direction. This current is shown as $-I_0$ at t = 0 in figure After T_3, T_4 are turned off at t = 0, current i_0 can not change its direction immediately because of the nature of load. As a result, diodes D_1,D_2 start conducting after t = 0 and allow i_0 to flow against the supply voltage V_s. As soon as D_1,D_2 begin to conduct ,load is subjected to V_s as shown. Through T_1,T_2 are gated at t = 0, these SCRs will not turn on as these are reverse biased by voltage drop across diodes D_1 and D_2. When load current through D_1,D_2 fall to zero ,T_1 and T_2 become forward biased by source voltage Vs , T_1 and T_2 therefore get turned on these are gated for a period T/2 sec. Now load current i_0 flows in the positive direction from A to B. At t = T/2; T_1, T_2 are turned off by forced commutation and as load current cannot reverse immediately, diodes D_3, D_4 come into coduction to allow the flow of current i_0 after T/2. Thyristor T_3,T_4, through gated ,will not turn on as these are reverse biased by the voltage drop in diodes D_3,D_4. When current in diodes D_3,D_4 drop to zero; T_3,T_4 are turned on as these are already gated. The conduction of various components of the full bridge inverter is shown in figure.



Load Voltage and Current Waveform for Single Phase Inverter

RLC Underdamped Load: the load current i0 for RLC underdamped load is shown in figure after t = 0; T_1, T_2 are conducting the load current. As i_0 through T_1, T_2 reduces to zero at t_1, these SCRs are turned off before T_3,T_4 are gated. As T_1,T_2 stop conducting ,current through the load reverses and is now carried by diodes D_1,D_2 as T_3, T_4 are not yet gated .The diodes D_1,D_2 are connected in antiparallal to T_1,T_2; the voltage drop in these diodes appears as a reverse bias across T_1,T_2. If duration of this reverse bias is more than the SCR turn off time t_q, i.e. .If ($T/2 - t_1$) >tq; T_1, T_2 will get commutated naturally and therefore no commutation circuitry will be needed. This method of commutation, knows as load commutation, is in fact used in high frequency inverters used for induction heating.