5.2 INDUCTION BASED APPLIANCES

Induction appliances get energy from the mains voltage, which is rectified by a bridge of diodes. A bus filter is designed to allow a high-voltage ripple, getting a resultant input power factor close to one. Then an inverter topology supplies the ac (between 20 and 100 kHz) to the induction coil. Today, burners of domestic induction appliances are designed to deliver up to 3.5 kW ac. A schematic diagram of the power stage of a domestic induction apparatus is shown in Figure 2. Formerly, the power electronics was located in a forced air- cooled separate box placed on the floor, using thyristors as switching devices. However, in the later 1990s, the application of the resonant inverter topologies caused the integration of the electronics and the inductors in a compact hob, whose housing is compatible with the conventional resistive cookers. Having in mind that hobs are normally placed over an oven, an environment temperature of 75ºC (167ºF) is usually considered for electronics design purposes, and a highly efficient energy conversion is mandatory. Today, resonant inverter topologies are commonly used in induction hobs. The most used topologies are the full bridge, half bridge, and two single-switch inverter topologies, namely zero-voltage switching (ZVS) and zero current switching. At present, the half-bridge topology is the most popular one because of its robustness and cost savings. Multiple-burner appliances with two or four inductors are commonly manufactured. In a multiple-burner induction cooker, the easiest approach is to use one inverter per burner or one inverter for two or more burners as other usual approaches, with benefits such as a lower overall cost and higher utilization ratio of electronics. In the last case, a common technique uses a single-output inverter, multiplexing the loads along the time periodically by means of electromechanical switches, causing a very low-frequency switching with power distribution and acoustic noise not completely satisfactory. The methods to avoid these problems have been proposed. An upgraded full-bridge inverter with two outputs has been proposed, and this concept has also been applied to the half-bridge inverter. It is a cost-effective proposal that provides new benefits, such as quick heating function, with an optimum utilization of electronics. Both the full- and half-bridge two-output inverters are based on sharing a common leg and adding two low-cost relays (S1 and S2) for paralleling the independent legs when only one output is required. Thus, the converters can be configured to supply either both outputs or only one. In addition, the topologies in resonant capacitors Cr_1 and Cr_2 and the snubber capacitors Cs_1–Cs_6 to get a ZVS operation of main switches. Considering a real implementation of the two output, full-bridge topology.

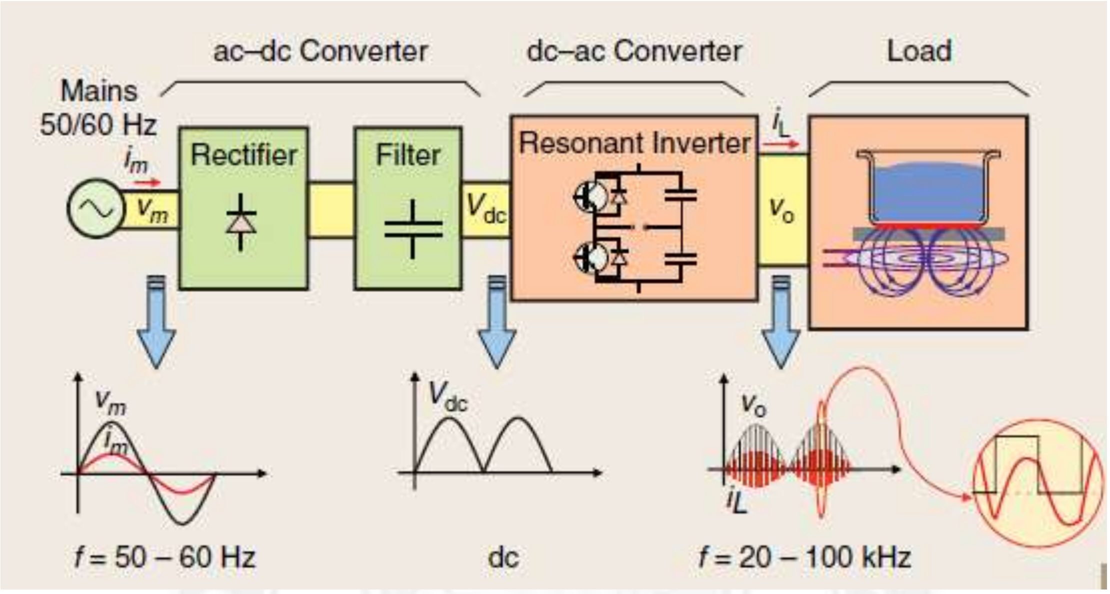

Figure 5.2.1 Power Electronic Circuit of Induction Cooker

[Source: "IEEE Industry Applications Magazine," Page: 40]

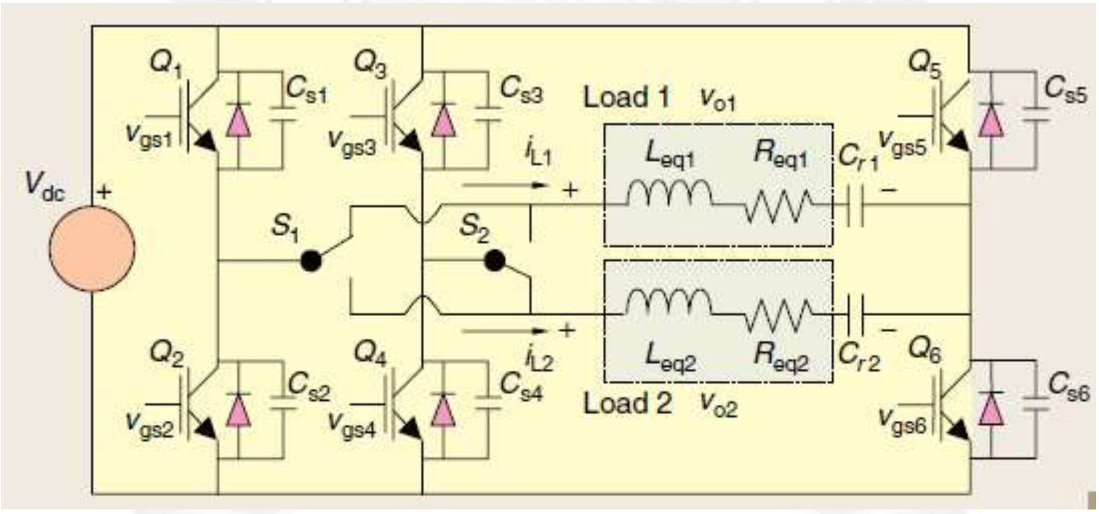

Figure 5.2.2 Full-bridge Resonant Inverter

[Source: "IEEE Industry Applications Magazine," Page: 40]

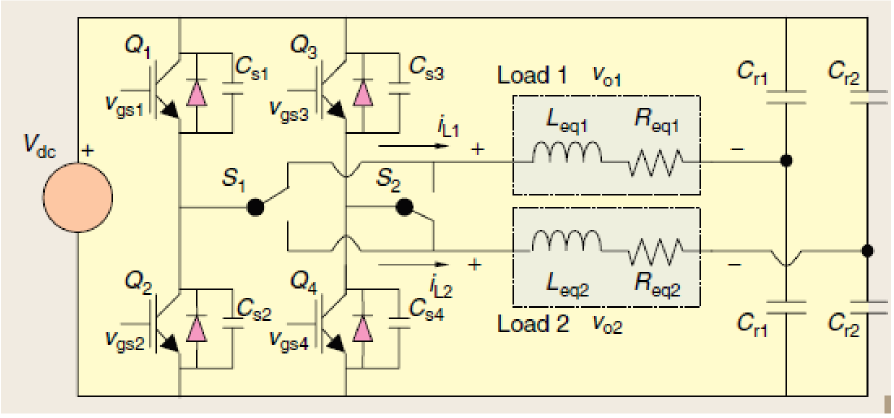

Figure 5.2.3 Half-bridge resonant inverter

[Source: "IEEE Industry Applications Magazine," Page: 41]

INDUCTION COOKER

Induction cooking works by using an electromagnetic field to heat the cookware. This is very different from the traditional gas flame or electric coil cooking experience. Special cookware is also needed. Cookware used on an induction cooktop must have iron content. This is what makes the pan magnetic and allows the transfer of energy to the pan or pot you are using. Electromagnetic Energy + Magnetic Pans = Fast, Efficient Induction Heating The key to induction cooking is electromagnetic energy. This kind of energy is around us every day in the form of AM and FM radio, cell phones, wireless laptops, microwave ovens, infrared, and visible light. It operates on a two-part system. First, beneath the ceramic surface of an induction cooking product is a copper coil. When an electrical current is passed through this coil it creates an electromagnetic field of energy. Second, an iron core pan is placed on the cooktop. At this point the heat is activated around the pan. The surface remains cool until both these steps are completed. The video below further illustrates the mechanics of induction cooking. Magnetic Cookware Required for Induction Heating for induction heat to occur, the bottom of the pan must be made of some iron, making the pan magnetic. You can perform a simple test to see if your pan will work with an induction cooktop. If a magnet sticks to the bottom, the pan will work on an induction cooktop. When the magnetic pan is placed on the cooking surface, the iron molecules in the pan begin to vibrate 20,000-50,000 times per second. It is the friction between those molecules that creates heat. All of the heat is contained in the bottom of the pan; this is why the surface remains cool while your cookware stays hot.