

Topologies adopted in the design and development of the single-phase to three-phase direct AC-AC matrix converter for poly phase loads

ABSTRACT

Three phase Induction Motors has numerous advantages compared to its single phase counter parts in terms of performance parameters. Due to its numerous advantages, single phase induction motors are being replaced by Poly phase induction motors in many applications. This change requires the three phase power supply readily available everywhere, but in real world, only single phase supply sources are available in most locations and its considered to be the most convenient form of energy source. On the other hand, its proven that the three phase equipment are more efficient and economical than single phase counterparts. In order to meet this requirement, techniques are being developed to utilize the readily available single phase source to produce a variable frequency three phase supply. Thus the Single Phase to Three Phase variable frequency Converter is highly desired. Advancement in the Power Electronics devices such as power switches, microelectronics devices, FPGA and DSP techniques leads to the innovation of more advanced converters with sophisticated characteristics. PWM inverters are widely adopted in the variable speed motor drives. IGBT Bi-directional switches based AC to AC converters are getting more popularity for its unrestricted performance. Cycloconverters are one of the popular circuits which are heavily utilized in the variable frequency drives. Cycloconverters can be classified into Naturally Commutated Cycloconverter (NCC) and Forced Commutated Cycloconverter (FCC). In NCC, switches can be turned off naturally by the supply voltage where as in the FCC, the turn off is independent of the supply voltage. Thus, the higher frequency conversion is only possible in FCC. Matrix Converters are one of the good examples for FCC. This paper attempts to explore various techniques and topologies adopted in the implementation of Matrix Converters for single phase to three phase conversion and recommends the appropriate topology with associated hardware.

Keyword: Bi directional switches; IGBT; Induction motor drives; Matrix converters