Converter for traction application.

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Abstract - ***In this paper an attempt is made to investigate the performance of PWM VSI-fed induction motor drive. The open loop Simulink model of the voltage source inverter-fed induction motor drive is presented. Simulation results are obtained for performance analysis of the drive under different loading conditions and are discussed in detail.***

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Key Words: *converter ,induction motor, pwm technic ,ac to dc converter, dc link , synchronous link converter* **,** *drive***.**

2.1 Introduction

In recent years, the popularity of PWM VSI has increased beyond recognition. Its dynamic performance and controllability are better than those of the dc drive. Its power range has extended to areas dominated for years by traditional solutions such as the cyclo converter and LCI drives. In 20th century, the three phase induction motors (IMs) were considered to be ideal for the electric railway traction because of the steep torque-speed characteristics and regenerative capability. The three phase traction system was first implemented in Germany for experimental purpose. It was also used in the Bergdorg – Thun line in Switzerland in the year 1899 and the Cascade tunnel in U S Great Northern Railroad in the year 1909 . And nowadays, the induction motors are used in the inverter-driven electric train. It can withstand the mechanical shock, high temperature and the vibration due to the harmonics present in the supply voltage of the inverter. Due to the absence of the brushes in IMs, the maintenance is low and the weight is reduced. It has better torque characteristics . These favourable characteristics of IMs served as a motivation to use IMs in the traction drive.
Almost for a century, induction motor has been the workhorse of industry due to its robustness, low cost high efficiency and less maintenance. The induction motors were mainly used for essentially constant speed applications because of the unavailability of the variable-frequency voltage supply. The advancement of power electronics has made it possible to vary the frequency of the voltage supplies relatively easy, thus extending the use of the induction motor in variable speed drive applications.

2.2 Three phase PWM inverter

In AC grid connected motor drives, a rectifier, usually a common diode bridge providing a pulsed DC voltage from the mains is required. Although the basic circuit for an inverter may seem simple, accurately switching these devices provides a number of challenges. The most common switching technique is called Pulse Width Modulation (PWM). In AC motor drives, PWM inverters make it possible to control both frequency and magnitude of the voltage and current applied to a motor. As a result, PWM inverter-powered motor drives are more variable and offer in a wide range better efficiency and higher performance when compared to fixed frequency motor drives. The energy, which is delivered by the PWM inverter to the AC motor, is controlled by PWM signals applied to the gates of the power switches at different times for varying durations to produce the desired output waveform. For step less speed control below and above the rated speed with high torque and to avoid the harmonics, the PWM inverter fed induction motor control is the best suitable one.

The PWM inverter has to generate nearly sinusoidal current, which can control the voltage and current with 120 degrees difference in each phase. The controlling signals of three-phase PWM inverters have many pattern controls. The operation of three-phase inverter can be defined in eight modes, which shows the status of each switch in each operations mode. In inverter operation, the necessary phase-leg-short is naturally realized through anti-parallel diodes in the three-phase bridge. Accordingly, the same gate pulses as in the conventional VSI can be applied. On the other hand, the switch on the DC link must actively operate. The recent advancement in power electronics has initiated to improve the level of the inverter instead of increasing the size of the filter.

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Fast switching of IGBTs (typically <1 ms) results in high dV=dt, typically 3–5 kV=ms, and possible voltage overshoot at turn-off that can last for a few microseconds. The fast rate of rise=fall of voltage combined with high peak voltage at the turn-off results in a premature failure of motors as well as EMC. The high-power PWM VSI using new power devices (IGBT=IGCT) appears to be the best solution for the future. Benefits include better power factor, no limit on frequency, and higher voltages. Potentially either the two-level or the multilevel solution will meet the market requirements.

2.3 Simulation result

The circuit of six switch three phase inverter system is shown in Figure 2.1. In three phase inverter fed drive system, AC is converted into DC using uncontrolled rectifier. DC is converted into variable voltage variable frequency AC using three-phase PWM inverter. The variable voltage variable frequency supply is applied to the motor .simulink result is been shown below figure 2.2, 2.3, 2.4, 2.5, 2.6, 2.7.

2.4 Figures

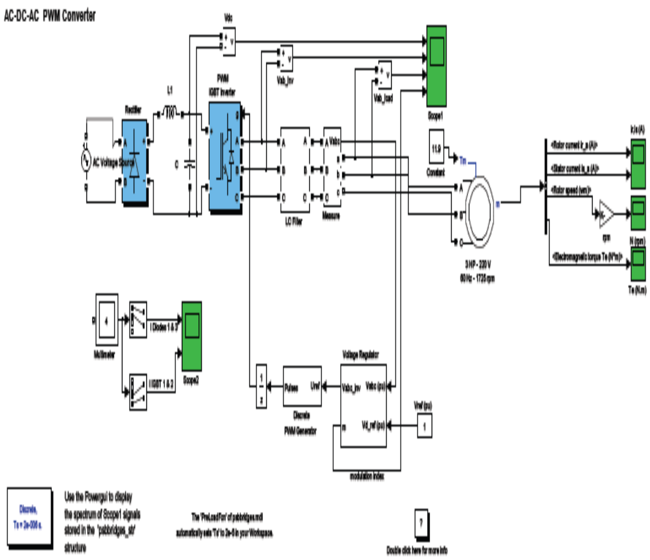


Figure 2.1.

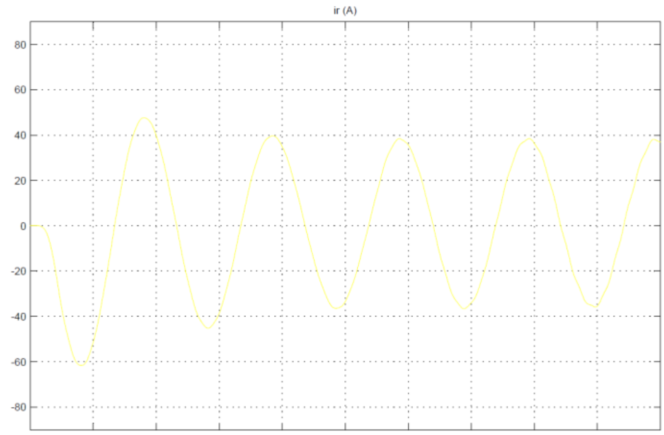


Figure 2.2.

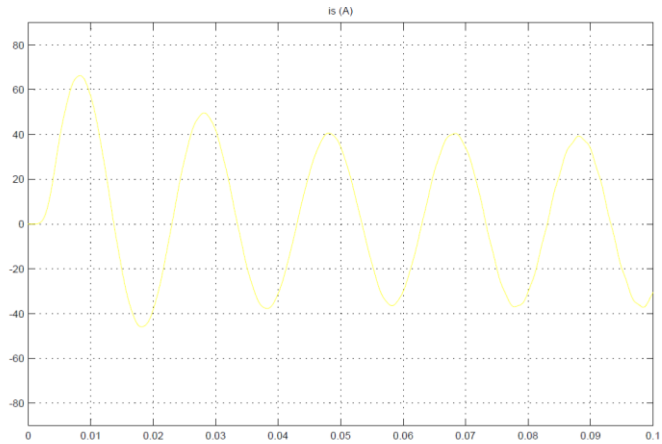


Figure 2.3.

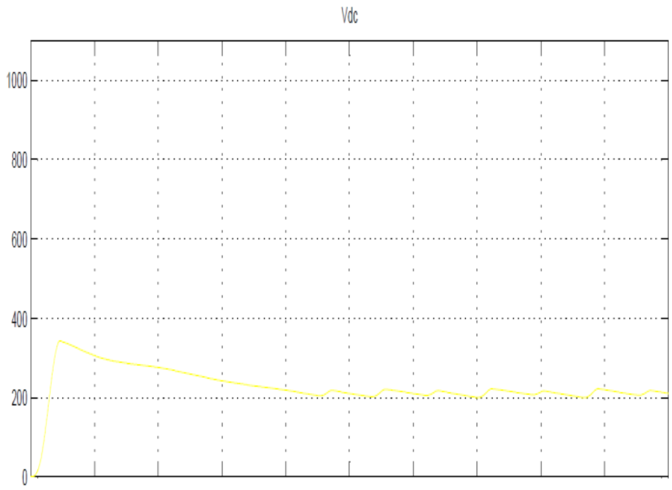
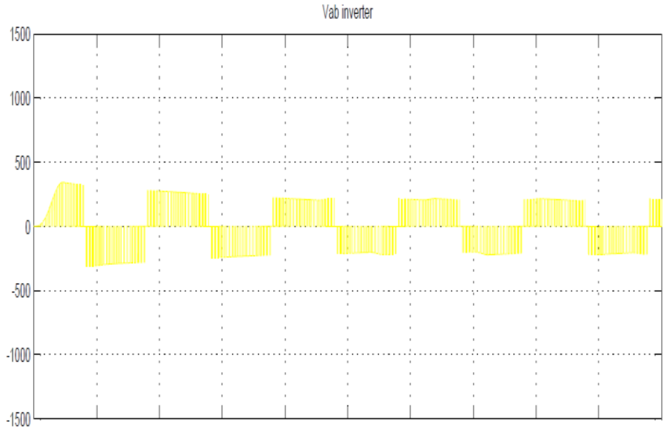


Figure 2.4.



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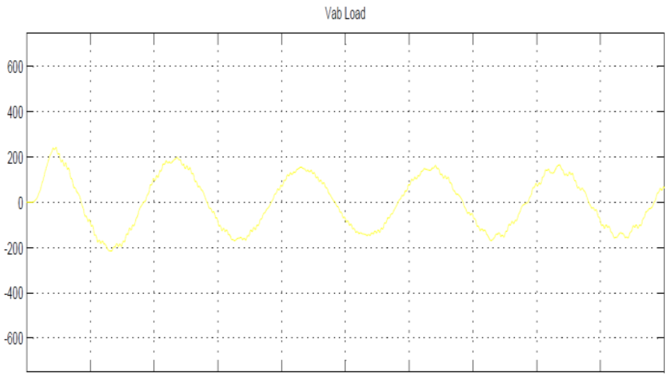

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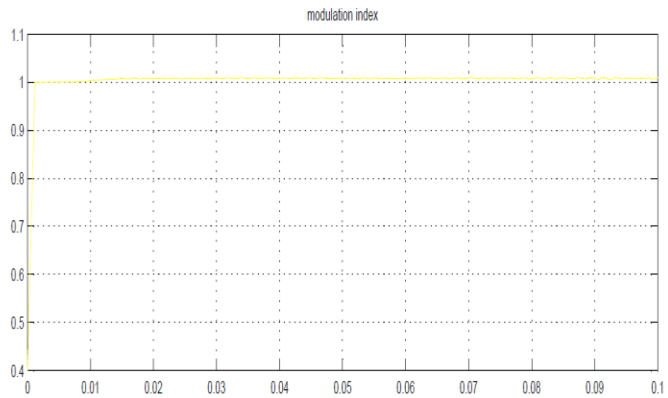

Figure 2.7.

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