www.ijiarec.com

ISSN:2348-2079

Volume-7 Issue-2

International Journal of Intellectual Advancements and Research in Engineering Computations

Controlling boiler feed water flow by using quasi-z-Source indirect matrix converter fed Induction motor drive

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ABSTRACT

This paper describes a flow control of water in boiler with the Quasi-Z-Source Indirect Matrix Converter (QZSIMC) fed induction motor drive. Decreases in level of water may uncover boiler tubes, causing them to become damaged and overheated. Increases in level of water causes reducing boiler efficiency and carrying moister into the turbine. The maintenance of the speed of induction motor at set condition, thus controlling the perfect flow of water in boiler.

Keywords: Quasi-Z-Source Indirect Matrix Converter, Proximity Sensor, Opto Coupler.

INTRODUCTION

Most induction motors are designed to operate at a constant speed and provide a constant output; however, new technology requires different speeds in many applications where electric motors are used. A variable induction motor drive is a device that regulates the speed and rotational force, or output torque of mechanical equipment. Effects of applying this drives are in both productivity improvements and energy savings in pumps, fans, compressors and other equipment. Variable speed drive technology and the importance of controlling the speed of existing motors have fascinated many attentions in the last years with the advent of new power devices and magnetic materials. A Z-source inverter (ZS) is a type of power inverter, a circuit that converts direct current to alternating current. It functions as a buck-boost inverter without making use of DC-DC Converter Bridge due to its unique circuit topology. The QZSI inherits all the advantages of the ZS, which can realize buck/boost, inversion and power conditioning in a single stage with improved reliability. Dual topologies of MC are Direct Matrix Converter (DMC) and Indirect Matrix Converter (IMC). DMC perform single stage conversion (AC-AC), while the IMC performs two stage conversions (AC-DC-AC) without DC link capacitor. Even though both converters have same characteristics, the DMC operates with complex commutation, while IMC has easy commutation. Inductive proximity sensors are widely used in various applications to detect metal devices. The proximity sensor converts the number of revolutions into pulses. Further those pulses are converted into voltage linearly and are given as input to PIC. Inverter circuits designed to produce a variable output voltage range are often used within induction speed controllers. The power for the inverter section can be derived from a normal AC wall outlet or some other source. Control and feedback circuitry is used to adjust the final output of the inverter section which will ultimately determine the speed of the induction motor operating under its mechanical load. Motor speed control needs are numerous and include things like industrial motor driven equipment, electric vehicles, rail transport systems, and power tools. The generated gate pulses are given to each switch in

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accordance with the developed pattern and thus the output is obtained. Boiler feed water flow can be controlled by varying the speed of the induction motor that controls the speed of the pump and modulates the water flow to the boiler [1-5].

EXISTING SYSTEM

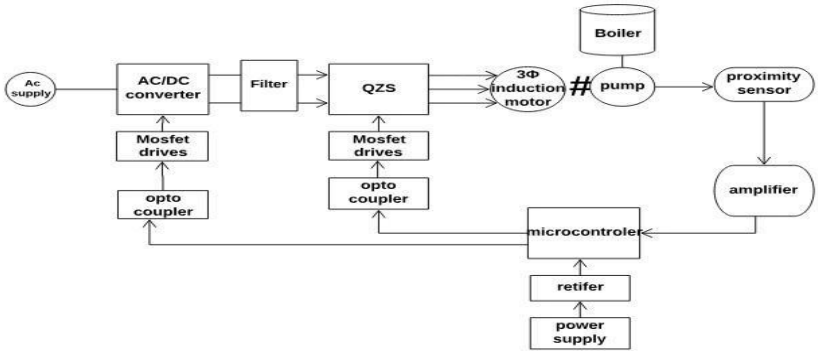
Existing system are used in paper industry by controlling the flow of dye depends on the speed of induction motor. When voltage sag occurs in the supply voltage it affects the speed of induction motor. To control the flow of dye even under voltage sag conditions, the variable boost QZSIMC with fuzzy controller has been proposed. In this paper a variable boost capability of the QZSIMC has been tested and analyzed for different voltage sag conditions.

Comparison of ZSN/QZSN to DMC/IMC, namely Z Source Direct Matrix Converter (ZSDMC) and Z-Source Indirect Matrix Converter (ZSIMC) increases the voltage transfer ratio and allows short circuit of the source. An increase in the voltage transfer ratio provides boost capability to ZSMC. In ZSDMC, the ZSN is sandwiched between the source and MC to improve the voltage transfer ratio. The ZSDMC topology allows entirely silicon solution, but still requires difficult commutation. This paper focus on the flow control dye based on Gram per Square Meter (GSM) of producing paper in SPB limited. The existing system was implemented in hardware to applied flow control of dye in the paper production process. The Seshasayee Paper and Board (SPB) Limited have its own power generation plant in which there is frequent occurrence of voltage sags. In SPB Limited Induction motor acquires almost 80% of the adjustable speed drive for different flow control of materials. The implementation of the PI and fuzzy controller for QZSIMC is done in simulation and fuzzy controller has been implemented in hardware using 4KW induction motor.

PROPOSED SYSTEM

Controlling the boiler feed water flow by using quasi z source indirect matrix converter fed induction motor drive. It is very important to maintain the water flow of the boiler, increases in level of water leads to interfere with the process of separating moisture from steam (i.e. carryover of saturated steam) within the drum, thus reducing boiler efficiency and carrying moisture into the turbine. A sudden decrease in water level may uncover boiler tubes, causing them to become damaged and overheated. The power supply is given to the autotransformer and it step down the voltage and it is given to filter circuit and it produce pure dc. The pure DC is given to the Quasi Resonant source inverter. The Quasi Resonant source inverter is used to convert the DC into AC without switching losses. Inverter output is given to the motor. Motor will be run and we have calculated the speed of the motor by proximity sensor and feedback data to microcontroller [6, 7].

BLOCK DIAGRAM OF PROPOSED MODEL



In this project, a1 phase, 220 V, 50 Hz - AC source supply is given to the auto transformer. Auto transformer is used for the step down purpose. The bridge rectifier is used to convert the AC to pulsating DC. The pulsating DC is given to the filter circuit to filter the harmonics present in the converted DC and produce pure DC. The pure DC is given to the Quasi Resonant source inverter. The Quasi Resonant source inverter is used to convert the DC into AC without switching losses. Inverter output is given to the motor. Motor will be run and we have calculated the speed of the motor by proximity sensor and feedback data to microcontroller. The output of microcontroller is connected to the OPTO coupler. An opto-isolator contains a source (emitter) of light that converts electrical input signal into light, a closed optical channel. Which detects incoming light and either generates electric energy directly, or modulates electric current flowing from an external power supply. Because LED's can sense light in addition to emitting it, construction of symmetrical, bidirectional opto isolators is possible. An opto coupled solid-state relay contains a photodiode opto-isolator which drives a power switch, usually a complementary pair of MOSFET. A slotted optical switch contains a source of light and a sensor, but its optical channel is open, allowing modulation of light by external objects obstructing the path of light or reflecting light into the sensor.

The output of OPTO coupler is connected to the MOSFET driver. The aim of the MOSFET is to be able to control the voltage and current flow between the source and drain. It works almost as a switch. The working of MOSFET depends upon the MOS capacitor. The MOS capacitor is the main part of MOSFET. The semiconductor surface at the below oxide layer which is located between source and drain terminal. It can be inverted from p-type to n-type by applying positive or negative gate voltages respectively.

When we apply the positive gate voltage the holes present under the oxide layer with a repulsive force and holes are pushed downward with the substrate. The depletion region populated by the bound negative charges which are associated with the acceptor atoms. The electrons reach channel is formed. The positive voltage also attracts electrons from the n+ source and drain regions into the channel. Now, if a voltage is applied between the drain and source, the current flows freely between the source and drain and the gate voltage controls the electrons in the channel. Instead of positive voltage if we apply negative voltage, a whole channel will be formed under the oxide layer. The output of MOSFET driver is connected to the input of quasi resonant DC-DC converter.

The Analog to Digital Converter input is taken from the output of load. An ADC is an electronic device which converts varying analog signals into digital signals so that they can easily be read by the digital devices. it have many applications in electronics projects. ADC converts the quantities of real world phenomenon in to digital language which is used in control systems, data computing, data transmission and information processing shows the input/ output relationship of an ADC. It is used to Controlling the output of variations. Variable resistor is connected to the input of ADC. It is used to change resistance according to our needs in an electronics circuit. a variable resistor is used in a circuit to control the current flow, it is known as a rheostat. Here one of the fixed terminals and the moving terminal is used. The third fixed terminal is left unused. Connecting in this way helps to reduce or increase the current through the circuit by just changing the position of the moving wiper. As the resistance changes, the current changes inversely. That is if there is an increase in resistance, the current through the circuit will decrease. Since these resistors have to carry a significant amount of current, they have to be mechanically strong enough to handle variations in current flow through them. Therefore, wire-wound resistive material is the most common choice when variable resistor is used as a rheostat. We can connect any three terminal variable resistors (mostly potentiometer) as a rheostat too. It is done by wiring the other unused fixed terminal and the moving terminal together, as a single terminal. Finally, the block output is shown is Digital Storage Oscilloscope display in the form sinusoidal waveforms.

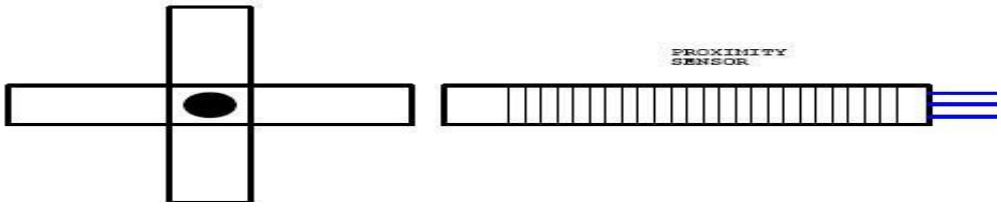
Filter

Electronic filters are circuits which perform signal processing functions, specifically to remove

unwanted frequency components from the signal, to enhance wanted ones, or both. Electronic filters can be: passive or active. Analog or digital.

Proximity sensor

Inductive proximity sensors are widely used in various applications to detect metal devices. They can be used in various environments (industry, workshop, lift shaft...) and need high reliability. Inductive proximity sensors generate an electromagnetic field and detect the eddy current losses induced when the metal target enters the field. The field is generated by a coil, wrapped round a ferrite core, which is used by a transistorized circuit to produce oscillations. The target, while entering the electromagnetic field produced by the coil, will decrease the oscillations due to eddy currents developed in the target. If the target approaches the sensor within the so-called "sensing range" the oscillations cannot be produced anymore: the detector circuit generates then an output signal controlling a relay or a switch.



Induction motor

An induction motor or asynchronous motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connection to the rotor. An induction motor rotor can be either wound type or squirrel-cage type. Three-phase squirrel-cage induction motors are widely used as industrial drives because they are rugged, reliable and economical. Single-phase induction motors are used extensively for smaller loads.

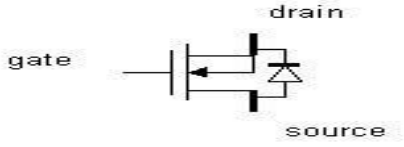
Pic Microcontroller

A microcontroller (or MCU for microcontroller unit) is a small computer on a single integrated circuit. In modern terminology, it is similar to, but less sophisticated than, a system on a chip or SoC and SoC may include a microcontroller as one of its components. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips.

MOSFET

MOSFETs come in four different types. They may be enhancement or depletion mode, and they may be n-channel or p-channel. We are only interested in n-channel enhancement mode MOSFETs and these will be the only ones talked about from now on. There are also logic-level MOSFETs and normal MOSFETs. We can use either type.

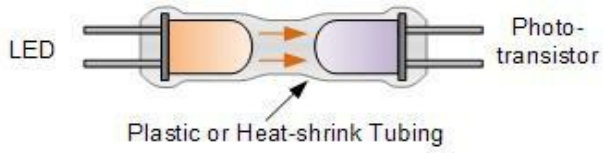
Mosfet Drive



To turn a power MOSFET on, the gate terminal must be set to a voltage at least 10 volts greater than the source terminal (about 4 volts for logic level MOSFETs). This is comfortably above the Vgs (th) parameter. One feature of power MOSFETs is that they have a large stray capacitance between the gate and the other terminals, C_{iss}. The effect of this is that when the pulse to the gate terminal arrives, it must first charge this capacitance up before the gate voltage can reach the 10 volts required. The gate terminal then effectively does take current. Therefore the circuit that drives the gate terminal should be capable of supplying a reasonable current so the stray capacitance can be charged up as quickly as possible. The best way to do this is to use a dedicated MOSFET driver chip.

Opto coupler

An Optocoupler is an electronic component that interconnects two separate electrical circuits by means of a light sensitive optical interface. Optocoupler and opto-isolators can be used on their own, or to switch a range of other larger electronic devices such as transistors and triacs providing the required electrical isolation between a lower voltage control signal, for example one from an Adriano or micro-controller, and a much higher voltage or mains current output signal.



CONCLUSION

The progress in science & technology is a non-stop process. New technology and new things are being invented. As the technology grows day by day, we can imagine about the future in which thing we may occupy every place. The proposed system based on Quasi Z source inverter is found to be more compact, user friendly and less complex, which can readily be used in order to perform. Several tedious and repetitive tasks. Though it is designed keeping in mind about the need for industry, it can extended for other purposes such as commercial & research applications.

REFERENCE

[1]. B. K. Bose, “Global Energy Scenario and Impact of Power Electronics in 21st Century,” IEEE Transactions on Industrial Electronics, doi: 10.1109/TIE.2012.2203771, 60(7), 2013, 2638-2651.
[2]. J.W. Kolar, T. Friedli, J. Rodriguez and P. W. Wheeler, “Review of Three-Phase PWM AC– AC Converter Topologies,” IEEE Transactions on Industrial Electronics, 58(11), 2011, 4988-5006.
[3]. L. Gyugi, and B. Pelly, “Static Power Frequency Changers, Theory, Performance and Application,”John Wiley & Sons, New York, USA, 1970.
[4]. Alesina and M. G. B. Venturini, “Analysis and Design of Optimum-Amplitude Nine-Switch Direct AC-AC Converters,” IEEE Transactions on Power Electronics, 4(1), 1989, 101-112.
[5]. T. Friedli, J. W. Kolar, J. Rodriguez, P. W. Wheeler, “Comparative Evaluation of Three-Phase AC–AC Matrix Converter and Voltage DC-Link Back-to-Back Converter Systems,” IEEE Transactions on Industrial Electronics, 59(12), 2012, 4487-4510.
[6]. Dieckerhoff, S. Bernet, and D. Krug, " Power loss-oriented evaluation of high voltage IGBTs and multilevel converters in Transformer less traction Applications," IEEE Transactions on Power Electronics, 20, 2005, 1328-1336.
[7]. R. Yapa, A. J. Forsyth, and R. Todd, " Analysis of SiC technology in two-level and three-level converters for aerospace.
[8]. Applications, " in Power Electronics, Machines and Drives, 7th IET International Conference on, 2014, 1-6.