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Soft start of Induction motor using ACPWM

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ABSTRACT

This project attempts a soft start control technique for the single-phase a.c. induction motor. The circuit operation is controlled by an 8051 family microcontroller.

The device is aimed at substituting the commonly used triac phase angle control drives.

It presents a design of a low-cost; high-efficiency drive capable of supplying a single-phase a.c. induction motor with a PWM modulated sinusoidal voltage during start.

Same as in triac control, the voltage applied to the load is varied from zero to maximum value in a small span of time during start. The circuit is capable of supplying a single-phase a.c. induction motor (or general a.c. inductive/resistive load) with varying a.c. voltage at the start. It uses a pulse width modulation technique (PWM), and when compared with the phase angle control used for triacs, it produces much lower high order harmonics. It directly modulates the mains a.c. voltage. Thus, it suits EMC/EMI regulations much better. Because the circuit is aimed at low-cost, low/medium-power applications, it does not use a conventional converter topology to produce the output voltage waveform. Compared with costly converter, it requires a lower number of active and passive power components.

The drive uses a PWM controlled MOSFET and the load in series with a bridge rectifier. The device attempted here takes advantage of both the low price of the phase angle control and the low harmonic content and high efficiency that we can get with standard converter topology. This drive based on this new control technique is targeted for use in consumer and industrial products: washing machine, dishwashers, ventilators, compressors. Soft starters have been widely used in fans and pumps drives. It is difficult to start high power heavy-duty induction motor for traditional soft starter. In this paper a new circuit is proposed in order to mitigate the adverse effects of starting torque transients and high inrush currents of induction motors. The proposed circuit consists of three similar diode-bridges and a single coil that each connects in series with each-phase of induction motor. This circuit has almost no effect in normal operation of induction motors. The simplicity of proposed circuit, easy to build and absence of control circuits are the main attractive points of circuit. The analytical analysis and designing characteristics for DC reactor in proposed circuit are presented. The overall circuit operation in transient and steady state cases are studied in detail. Simulation results are obtained to verify the valuable operation of proposed circuit in soft starting.

INTRODUCTION

Single-stage enrollment motors (SPIMs) are solid, easy to stay aware of and their cost is low. So SPIMs are by and large used in various industrials and home contraptions, for instance, garments washers, dishwashers, coolers, environment control frameworks, vacuum cleaners, siphons, blowers, etc Be that as it might, not in the slightest degree like a threephase selection motor, the SPIMs can't convey their own starting power. In light of everything, the alluring field created by a lone stage stays fixed prepared and pulsates with time. Since there is no turning alluring field, a SPIM can't run without any other individual without additional equipment. Hence, customary procedures to start a SPIM join Split-Stage, Capacitor-Start, Extremely sturdy Split Capacitor (PSC), Capacitor-Start Capacitor-Run (CSCR), and Concealed Post (SP) [1], [2]. In any case, when a SPIM is started by the prompt starting procedures for the legitimate system structures, the engine starting stream can be around 500~700% of the evaluated motor stream, which can make an over stream electrical structures and a power flood to mechanical systems. There have been a wide scope of studies to decrease starting current. At first, an autotransformer and a tapped winding arrangement are used to decrease the voltage ampleness which is given to a SPIM to limiting starting current . However, while considering the size, weight and costs of the transformer, this strategy may not be positive. Additionally stage control strategies are reasonable and insignificant cost procedures for diminishing huge starting streams by using thyristor-based voltage control . In any case, these procedures achieve convulsive data current waveforms which contain odd and even sounds alongside sub-music of the reserve repeat which outperform consonant end standards. As needs be, nowadays Heartbeat Width Tweak (PWM) inverter techniques have become solid as a choice considering the way that these strategies can overcome the issues related with the ordinary thyristor-based voltage control. Different PWM converter topographies, for

instance, a dc-interface converter and a forced air system ac converter have been explored. The PWM action at high slicing frequencies will achieve music appearing at higher frequencies where they can be actually discarded by a little estimated channel

present a sensitive starting of enrollment motor. At the hour of starting selection motor takes particularly colossal current and have low power factor. In view of this high current the motor contains high power and vagrants and as a result of this transient and high power the motor experienced jerk and thusly life of rotor lapses. To restrict this troublesome effect of high starting current one procedure is used which is electronically controlled fragile highlighting of the acknowledgment motor. By using sensitive starter execution of enrollment motor is improved and besides further created load force characteristics

High starting stream achieves a mechanical jerk and high electrical load on the windings of the motor. On occasion the windings could get seared.

Litrature Overview

. The nuances of the entertainment of the acknowledgment motor and ac voltage controller have been shown in many examines (H. A. Alhurra. Ibrahim, 2007; Ghastly,;M. M. Ahmed, 2005;Xu Dianguo;Zhao Keqiang Yi. 2003; Rajaji, Alkmaar, C.

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The electric power usage of AC motor is an exceptional piece of irrefutably the local use. Along these lines, high capability and strength of AC motor can comprehend energy-saving and cost lessening truly. Not simply AC motor ought to be fragile started to reduce stream flood and zapped obstruction voltage-drop, yet furthermore its speed ought to have the choice to changed as per further foster capability. Three-stage odd motors have typical for essential development, lower costs, incredible mechanical properties, basic action and backing. They are extensively used in current control and electrical drive structure. Likewise people raise progressively high essentials to the starting display. If the selection motor is started clearly, its starting current will at last rely upon 5-8 times the assessed regard, which causes a sharp reduction in voltage of the communicating power network,affecting normal action of various supplies and causing an unprecedented impact on the motor, especially on keep type rotor whose bars and rings would be decimated tremendously. As the improvement of the power equipment advancement, PC control development and customized control development, electronic sensitive starting controller has appeared (Liang, X. et al, 2011). While in generally, the starters accessible simply have essential modes, for instance, current-confined and voltage step inclining fragile start. Notwithstanding the way that it can fulfill the necessities of most kinds of weights, the starting state isn't great (Gui-xi, Jia et al, 2010) (Nied, A. et al, 2010). Direct electronic selection machine starts have numerous downsides. Force pulsates are regularly tremendous and change from positive to negative characteristics. These power vagrants in a motor shaft are shipped off the stack, achieving mechanical wear in the motor heading and weight couplings. Thusly, properly controlling the starting streams and powers of selection machines is basic generally speaking. Besides, the resulting starting streams are high, especially during the underlying very few examples of a starting transient. These high streams are continued on by the motor and power structure, causing the warming of the machine windings (Imprint G. et al, 2006). Like acknowledgment motor (IM) variable speed drives, sensitive starters are furthermore major parts in each state of the art IM drives and motorization structures (Adel Gastli et al, 2005). Different undertakings have been made on the show assessment and control procedures of a three-stage IM dealt with from a thyristorized voltage controller (G. Nath et al, 1981) (S. A. Hamed et al, 1990). In (W. Deleroi et al, 1989), a novel limit was used for the thyristor setting off point in the voltage controller winding up a direct and feasible strategy for dealing with transient execution. The rate at which the rule change creates is reduced, and the transient power is smoothed by using a proper setting off work.

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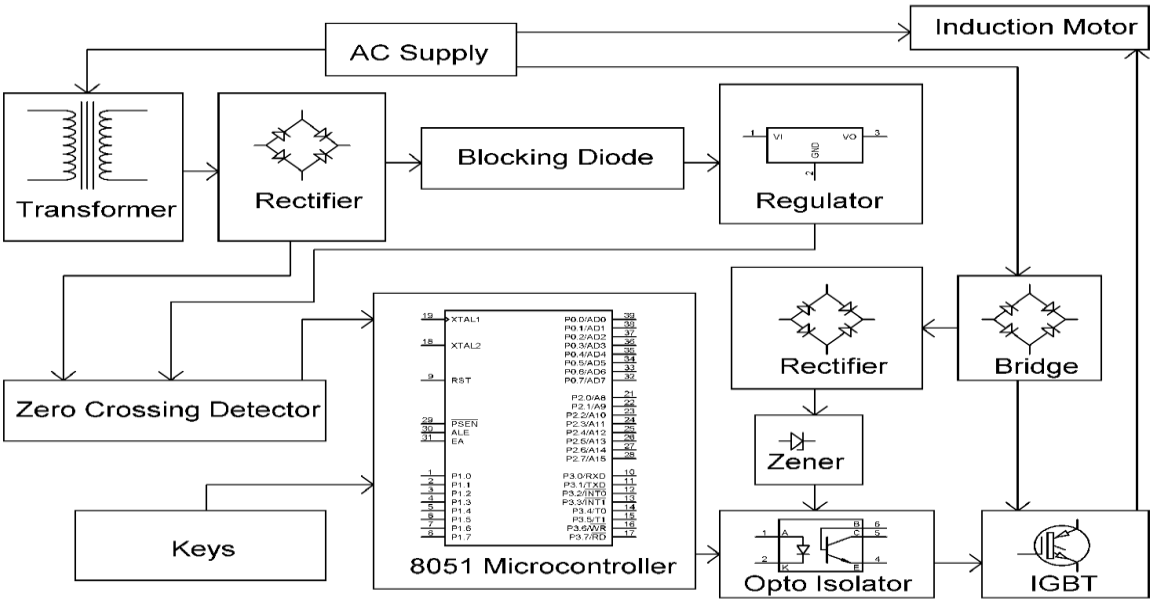
Objective of Project

- This project attempts a soft start control technique for the single-phase a.c. induction motor.
- The circuit operation is controlled by an 8051 family microcontroller.
- It presents a design of a

PROJECT BLOCK DIAGRAM



low-cost; high-efficiency drive capable of supplying a single-phase a.c. induction motor with a PWM modulated sinusoidal voltage during start.

- It uses a pulse width modulation technique (PWM), and when compared with the phase angle control used for triacs, it produces much lower high order harmonics.

Philosophy

This task endeavors another speed control method for single stage AC enlistment engine. It has minimal expense, high proficiency drive fit for providing a solitary stage acceptance engine with PWM tweaked sinusoidal voltage. The circuit activity control by a 8051 family microcontroller. The gadget is pointed toward subbing regularly utilized TRIAC stage point control drives. The circuit is fit for providing single stageacceptance engine (inductive or resistive burden) with changing AC voltage

HARDWARE IMPLIMENTATIONS AND WORKING

Microcontroller AT8051 The AT8051 is a low-power, elite execution CMOS 8-bit microcontroller with 8K bytes of in-framework programmable Flash memory. The gadget is produced utilizing Atmel's high-thickness non-unstable memory innovation and is viable with the business standard 80C51 guidance set and pin out. The on-chip Flash permits the program memory to be reconstructed in-framework or by a customary non-unstable memory software engineer. By consolidating an adaptable 8-digit CPU with in-framework programmable Flash on a solid chip, the Atmel AT8051 is a strong microcontroller which gives a profoundly adaptable and practical answer for some installed control applications

Benefits

- Smooth speed increase of engine, little size of regulator.
- Beginning current can be changed in accordance with little worth,
- Music decrease is conceivable
- generally speaking upkeep
- cost of engine diminishes.

Inconveniences

- Produces sounds (not as much as inverter)
- Working rate of engine fixed (not at all like VFD, recurrence is fixed)
- Speed guideline is unimaginable (utilized for just beginning and halting and assurance)
- Speed increase and deceleration time more rely upon load.

APPLICATIONS

- A Soft Starter is a gadget that turns over engines with diminished power provided at fire up. Diminishing the power decreases possibly harming electrical and mechanical shocks on the framework.

- As the name suggests, starters "begin" engines. They can likewise stop, invert, speed up and safeguard them. Whether it's a little fan, or piece of mining hardware, electric engine are regularly the main thrust behind them. Electric engines consume 60% to 70% of all energy utilized in the United States.
- Delicate Starters are a blend of a regulator and over-burden insurance.

FUTURE SCOPE

The working season of electromagnetic hand-off can be improved by utilizing refined electronic parts

End

A straightforward procedure to control the acceptance engine electromagnetic force during delicate beginning has been introduced. Utilizing this strategy, the engine force can be customized by the heap force, and the speed increase can be kept up with consistent over the whole beginning period. The proposed technique takes out the shaft-force throbs during the beginning system and increment the existence of the acceptance engine.

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