Novel Soft-start Improved Efficiency Single phase Induction Blower Motor Drive

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ABSTRACT **:** This project presents a simple novel soft start and speed control of single stage fan regulator with higher force factor. An examination of customarystagepoint-controlled fan controllers utilising TRIAC as controllable switch and the proposed High recurrence beat width tweaked controlled fan controller is introduced. The motivation behind creating proposed fan controller is to improve the effectiveness, power factor and in this way the general execution of fan engines. We have used a single IGBT switch only for economy and made it to control AC voltage across fan motor. Although, normally IGBTs, are used only to control DC voltage or in DC to AC inverters. But we have used a single IGBT with a diode-bridge, to control the AC to Variable AC voltage directly. We have compared the results of existing technique and our technique to validate the results.

Keywords— High force factor; direct speed control; PWM control; Single stage enlishment engine;

- **INTRODUCTION :**

Simultaneous Efficiency and Power factor improvement with economy and simplicity of control of an AC single phase motor is the need of the hour. Existing technique uses two back-to-back thyristors or a TRIAC with firing angle control technique for this purpose. However, although the speed control of acceptance engine is accomplished, it is at the cost of decreased power factor, decreased efficiency and increased low frequency harmonic losses. In this project we have developed and tested our modified fan speed controller to improve above mentioned performance parameters e.g., lower stator copper losses higher productivity, higher force factor lower symphonious twisting with wide range speed control from 10%-100% speed range. We have used single IGBT switch only for economy and made it to control AC voltage across fan motor. Although, normally IGBTs, are usedonly to control DC voltages or in DC to AC inverters. But we have used a single IGBT with a diode-bridge, to control the AC to Variable AC voltage directly. We have compared the results of existing technique and our technique to validate the results.

I.CONVENTIONAL TECHNIQUES:

- **Phase angle control fan regulator:**

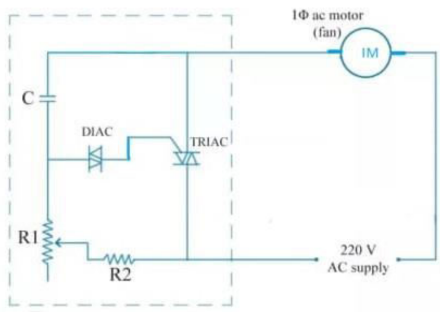


Fig.1.Phase Angle control fan regulator

TRIAC and stage point controlledtechnique is generally utilized these days. Stage point control fan controllers comprise of TRIAC as a bidirectional controllable semiconductor switch. engine voltage constrained by shifting terminating point of TRIAC. As the terminating point increments speed of the enlistment engine diminishes. The benefit of this strategy over previously mentioned strategies are power saving, minimal expense, volume and weight of the controller. Nonetheless, it experiences the advantage of poor power factor at lower speeds. In this paper we have analyzed the trial afterefects of stage point control type controllers and the proposed high recurrence PWM controlled fan controllers.

II. Analysis

(i) Phase point-controlled AC to AC voltage regulator RMS worth of yield voltage across enlishment engine is given by

$V_{0rms} = Vs/(л)^{1/2}*[л-α+(\sin2α)/2]^{1/2}$ ------------------ (1)

Where, Vs = RMS worth of the AC source voltage

V0rms = RMS worth of the output voltage

α= terminating point

$V_{0rms} = 2V_m \cos(α)/л$ ----------------------------(2)

V_m= pinnacle worth of the AC source voltage Vs

From Eq.(2) we reason that

force factor (pf) Proportional to cos(α) as the terminating point (α) expands power factor diminishes

Mechanical force of fan engine $P_m=T_L*\omega$-----------(3)
TL relative to N^2 therefore, $P_m$relative to N^3
Electrical power of engine = $V_S I_S \cos\varnothing$-----------(4)
As $\cos\varnothing=\cos\alpha$
$I_S$relative to $P_m/(V_S\cos\alpha)$

Is relative to N^3 /($V_S\cos\alpha$)
Force misfortune in enlistment engine is relative to $I_S^2R_S$
Where, I_S source current, R_S is stator twisting of engine.
In this way, we can presume that if the force factor is low source current incrementin this way $I_S^2R_S$ is additionally increments.
$pf=(I_S/I_0)*\cos\alpha$---------------------(5)
Where, I_0 is RMSload current, I_S/I_0 is contortion factor also, cosα is uprooting factor.
For any mutilated waveform contortion factor is not exactly solidarity while for sinusoidal waveform contortion factor is solidarity.
(ii) Pulse width adjusted controlled voltage regulator
RMS worth of yield voltage for beat width balanced method is given by
$V_{0rms}=V_S*(2d/\pi)^{1/2}$ -----------------(6)
Where d is the width of single pulse
From the above logical information of regularstage point control strategy we infer that relocation factor and the contortion factor ought to be solidarity to get solidarity power factor. solidarity power factor decreases the source current drawn by the engine which serves to diminishes $I_S^2R_S$ loss and do not cause warming of stator twisting of engine. Along these lines proposed PWM strategy is utilized to improve engine execution.

III. HARDWARE RESULTS OF PHASE ANGLE CONTROL REGULATOR

At firing angle α = 15 degree

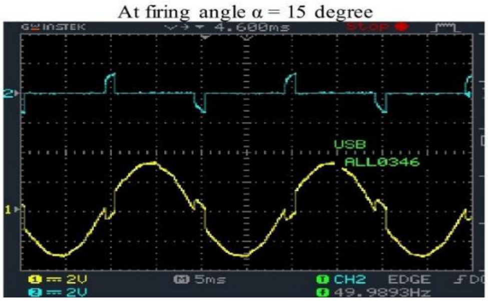


Fig.2 Blue waveform shows voltage across switch (Vsw)
Yellow waveform shows voltage across load (V0)
Vsw = V0 = 200 volts/division
Time T = 5 millisecond/division

At firing angle α = 60 degree

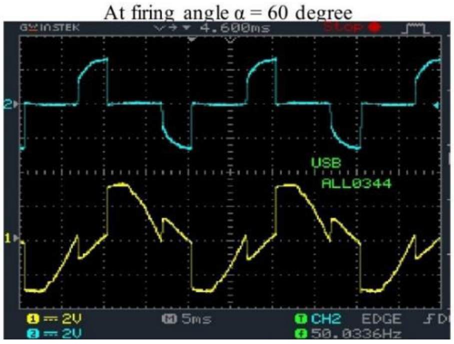


Fig.3 Blue waveform shows voltage across switch (Vsw)
Yellow waveform shows voltage across load (V0)
Vsw = V0 = 200 volts/division
Time T = 5 millisecond/division

From the above consequences of Phase point control controller, voltage which shoes up across load is not sinusoidal when terminating point is more. Voltage does not tumbles to zero when switch turns OFF and because of reverse recovery time it falls up to some negative value.

IV. PROPOSED TECHNIQUE:

To defeat weakness of ordinary strategies these proposed method is presented. This method is use for speed control of fan utilising PWM. PWM is produced utilising oscillator and high slew rate comparator and Speed control is accomplished by changing PWM having steady recurrence and variable obligation cycle. This plan gives high force factor at any speed and henceforth lessens energy utilisation. A semiconductor high recurrence switch MOSFET is utilized in this strategy.

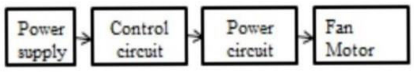


Fig.4 Block diagram of PWM control fan regulator

In this procedure power circuit is comprise of extention rectifier of four force diodes, MOSFET as a switch and freewheeling capacitor. Single stage supply is taken care of to the fan through MOSFET by obligationproportion control. The fan is associated between supply terminals and info terminal of rectifier connect, semiconductor switch MOSFET is associated at the yield terminal extention rectifier. At the point When the single stage supply is given to the circuit, control circuit creates PWM which is only the door beat for the switch MOSFET. The beat is then given to the switch and it gets ON then current beginnings coursing through diodes of extension during this activity a freewheeling capacitor likewise gets charge. While during OFF season of switch and beat is at zero state freewheeling capacitor gets release and gives supply current to the engine of fan. To get high velocity of fan PWM is created to such an extent that ON time is full and OFF time is zero. while to get least speed ON time is made very less and OFF time is more at steady high recurrence. During this activity of speed control voltage that shows up across load shows up as same as source voltage, bending and uprooting factor is likewise irrelevant which assistswith improving force factor and productivity of engine.

Modes of operation:

Conduction mode:

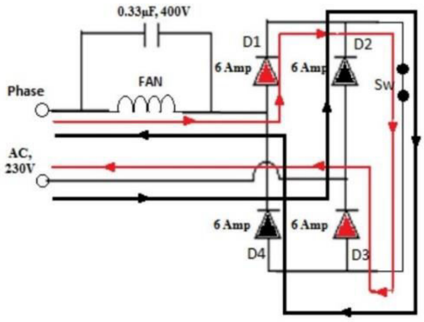


Fig.5 Conduction mode

At the point when the switch is ON current moves through stator winding simultaneously freewheeling capacitor associated across load gets charged.

Freewheeling mode:

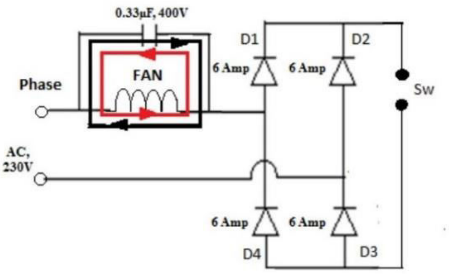


fig. 6 freewheeling mode

In freewheeling mode switch is Turn OFF and engine can't draw current from supply as of now freewheeling capacitor which is associated across load supplies voltage to the engine.

Hardware results for PWM control fan regulator:

At duty ratio K = 0.6

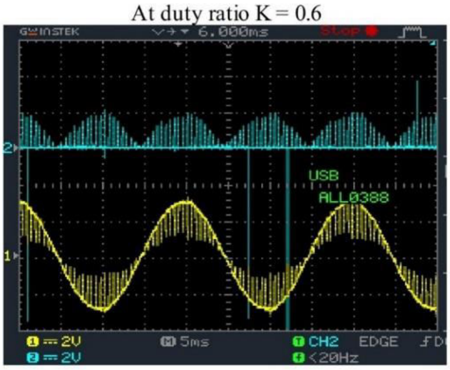


Fig. 7 Blue waveform shows voltage across switch (Vsw)
Yellow waveform shows voltage across load (V0)
Vsw = V0 = 200 volts/division
Time T = 5 millisecond/division

At duty ratio K = 0.45

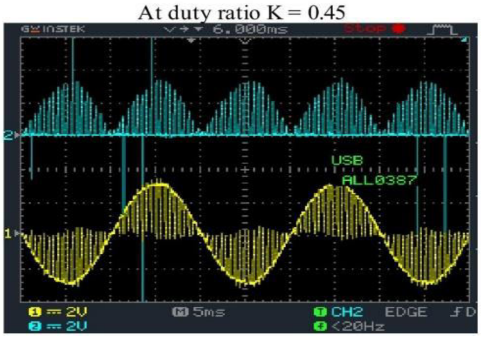


fig. 8

Blue waveform shows voltage across switch (Vsw)
Yellow waveform shows voltage across load (V0)
Vsw = V0 = 200 volts/division
Time T = 5 millisecond/division

At duty ratio K = 0.1

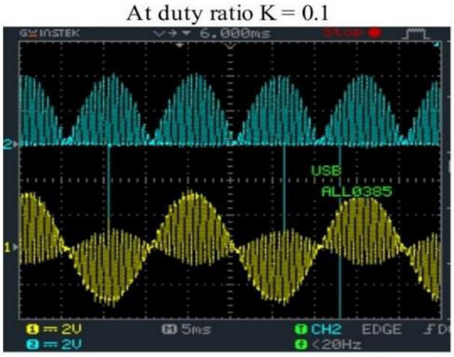


fig. 9 Blue waveform shows voltage across switch (Vsw)
Yellow waveform shows voltage across load (V0)
Vsw = V0 = 200 volts/division
Time T = 5 millisecond/division

Observation table and graphs:

Correlation of stage point control controller with Pulse Width Modulated control (PWM) controller on roof fan based on engineboundr are as follows:

Table1: Voltage, Power factor and Speed for Phase angle control regulator

Sr. no.	Load Voltage (volts)	Power Factor	Speed (RPM)	I/P Power (Watts)	THD (%)	Current (Amp)
1	94	0.28	80	35.41	80	0.2
2	106	0.321	120	36.84	77	0.23
3	123	0.427	164	38.64	65	0.26
4	144	0.504	208	42.73	58	0.32
5	161	0.579	247	45.91	46	0.36
6	179	0.676	282	46.15	34	0.42
7	194	0.815	324	48.46	22	0.49
8	218	0.974	356	49.76	15	0.53
9	233	0.999	378	50.52	5	0.6

Table2: Voltage, Power factor and Speed for PWM control regulator

Sr. no.	Load Voltage (volts)	Power Factor	Speed (RPM)	I/P Power (Watts)	THD (%)	Current (Amp)
1	94	0.998	80	20.45	25	0.1
2	106	0.998	120	21.64	23	0.18
3	123	0.999	164	28.61	20	0.24
4	144	0.998	208	33.49	19	0.29
5	161	0.997	247	37.74	16	0.34
6	179	0.997	282	39.68	14	0.39
7	194	0.995	324	42.51	11	0.45
8	218	0.993	356	45.96	8	0.51
9	233	0.993	378	48.12	5	0.6

From table 1 and table 2 we can assess that the exhibition of engine improved utilizing PWM strategy. The boundriesappeared in tables are addressed in afterdiagrams to get similar examination of both traditional and proposed procedure.

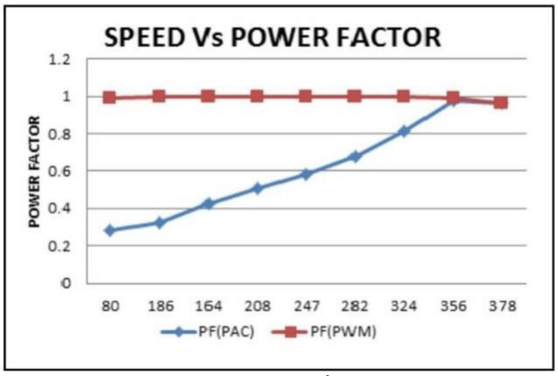


Fig. 10 speed V/s power factor

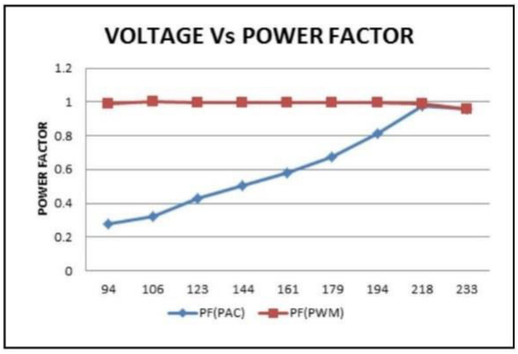


Fig.11 Voltage Vs Power factor

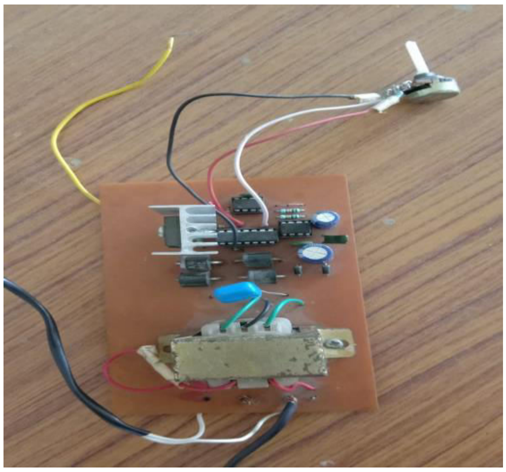
V. Result:

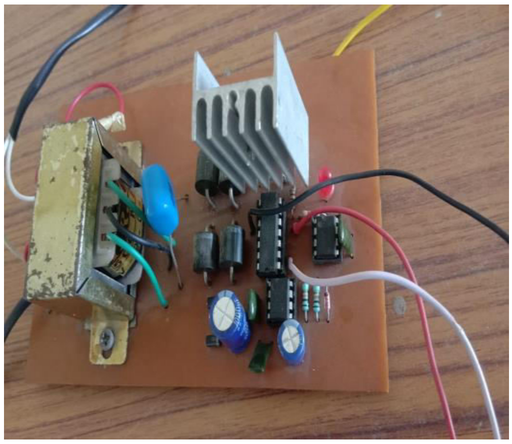
From fig.10 we can notice the force factor is high at low speed just as at fast speed in PWM procedure where as in customary stagepoint strategy power factor is poor at low speed as voltage is directly relative to speed. Also in fig.11 power factor is high at low just as high voltage in PWM procedure power factor is poor at low voltage.Likewise, from above equipment results we presume that the displacement factor and contortion factor is accomplishedutilising Pulse width tweaked procedurewhich gives higher force factor on each speed of fan engine.

VI. Conclusion:

The proposed research work presents high force factor high recurrence fan controller. This PWM fan controller gives a more power factor at each speed of fan. This strategy is proficient for power saving. This controller is likewise use to control speed of single-stageacceptanceengine with improved force factor. Likewise lower order harmonics are diminished utilizingnumerous pulses in single half cycle, therefore it is important to utilize this controller for single stage enlistment engines which burns-through greatest force at low speed.

MODEL DIAGRAM:





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