Adaptive PI Controller Using Statcom For Voltage Regulation

Nilesh kamdi, Rahul Dekate

Electrical Engineering
Suryodaya College of Engineering & Technology, Nagpur

Abstract

TATCOM can give quick and effective responsive power support to keep up control framework voltage solidness. This paper proposes a fluffy control show in light of versatile PI control, which can self-modify the control picks up amid an unsettling influence to such an extent that the execution dependably coordinates a coveted reaction, paying little mind to the difference in working condition. Since the alteration is self-governing, this gives the fitting and-play capacity for STATCOM activity. In the reproduction test, the versatile PI control demonstrates steady perfection under different working conditions, for example, extraordinary beginning control increases, distinctive load levels, change of transmission organize, continuous unsettling influences, and an extreme aggravation. Interestingly, the traditional STATCOM control with tuned, settled PI picks up for the most part perform fine in the first framework, yet may not execute as effective as the proposed control technique when there is a difference in framework conditions.

Key words: - *Microcontroller, Transformer, Driver, SCR, Regulator,A to D converter*

1. INTRO DUCTION

Voltage solidness is a basic thought in enhancing the security and unwavering quality of energy frameworks. The static compensator (STATCOM), a well known gadget for responsive power control in view of door side road (GTO) thyristors, has increased much enthusiasm for the most recent decade for enhancing power framework solid. In the past, different control techniques have been proposed for STATCOM control. References predominantly center around the control plan instead of investigating how to set relative indispensable (PI) control picks up. In numerous STATCOM models, the control rationale is executed with the PI controllers. The control parameters or increases play a key factor in STATCOM execution. By and by, few investigations have been completed in the control parameter settings. In the PI controller picks up are composed for a situation by-contextual analysis or experimentation approach with tradeoffs in execution and effectiveness. As a rule, it isn't plausible for utility architects to perform experimentation concentrates to discover reasonable parameters when another STATCOM is associated with a framework. Further, regardless of whether the control picks up have been tuned to fit the anticipated situations, execution might frustrate when an impressive difference in the framework conditions happens, for example, when a line is redesigned or resigns from. The circumstance can be surprisingly more dreadful if such transmission topology change.

In this manner, the STATCOM control framework may not perform well when generally required. A couple, however constrained past works in the writing examined the STATCOM PI controller picks up with a specific end goal to better upgrade voltage strength and to dodge tedious tuning. For example, in straight ideal controls in light of the direct quadratic normal (LQR) control is proposed. This control relies upon the architect's involvement to get ideal parameters. In, another STATCOM state input configuration is presented in light of a zero set idea. Like the last picks up of the STATCOM state criticism controller still relies upon the fashioner's decision. In, a fluffy PI control techniques is proposed to tune PI controller picks up. In any case, it is still up to the architect to pick the real, deterministic additions. In the populace based inquiry method is connected to tune controller picks up. Be that as it may, this technique as a rule needs a long running time to compute the controller picks up. A tradeoff of execution and the assortment of task conditions still must be settled on amid the planner's basic leadership process. Along these lines, very productive outcomes may not be constantly achievable under a particular working condition. Not quite the same as these past works, the inspiration of this paper is to propose a control technique that can guarantee a fast and steady wanted reaction when the framework activity condition fluctuates.

2. LITERATURE REVIEW

S. Dahal studied in transmission systems, Flexible AC Transmission System (FACTS) is a power electronic based innovation to improve controllability, strength and power exchange capacity of air conditioning transmission framework. Realities gadgets are observed to be exceptionally successful for dependability took after by an unsettling influence. Static Synchronous Compensator (STATCOM) which is a shunt gadget of FACTS family is productive in controlling voltage either by engrossing or by creating receptive power. Contrasted with different FACTS gadgets, STATCOM can give quick and effective receptive power support to keep up control framework voltage strength. This paper proposes a PI control display that controls the voltage amid an aggravation.

Maintain Voltage Regulation A STATCOM Provides the Fast and effective receptive power. So as to comprehend different STATCOM control strategies are examined in the writing. Be that as it may, in those strategies they utilize the trail and mistake approach techniques so the execution is exchange off. so at various working focuses the control parameters may not be compelling for the ideal execution. Keeping in mind the end goal to beat this issue a versatile control procedure came in to picture, in which the control picks up consequently self balanced according to our coveted reaction even with the difference in working condition that is the reason we named as independent change.

In the writing, different STATCOM control techniques have been talked about including numerous utilizations of corresponding essential (PI) controllers. Thus, control parameters for the ideal execution at a given working point may not be viable at an alternate working point. This paper proposes another control display in view of versatile PI control, which can self-modify the control picks up amid an unsettling influence. Voltage direction is a basic thought for enhancing the security and unwavering quality of energy frameworks.

3. METHODOLOGY

This work in PI control is required for non coordinating any procedure that in the long run come back to a similar yield given a similar set info and aggravation yield given a similar set information and unsettling influences PI controller is most appropriate to incorporating process.

That the versatile PI control gives reliably amazing execution under different working conditions, for example, extraordinary introductory control increases, diverse load levels, changes of transmission organize, back to back unsettling influences and an extreme aggravation.

The PI control parameters can act naturally balanced consequently and powerfully under various unsettling influences in a power framework.

The STATCOM with settled PI control parameters may not come to the coveted and satisfactory reaction in a power framework when the power framework working condition (e.g., burdens or transmissions) changes.

An versatile PI control technique is exhibited in this area keeping in mind the end goal to acquire the coveted reaction and to abstain from performing experimentation concentrates to discover appropriate parameters for PI controllers when another STATCOM is introduced in a power framework control strategies.

4. DISCUSSION

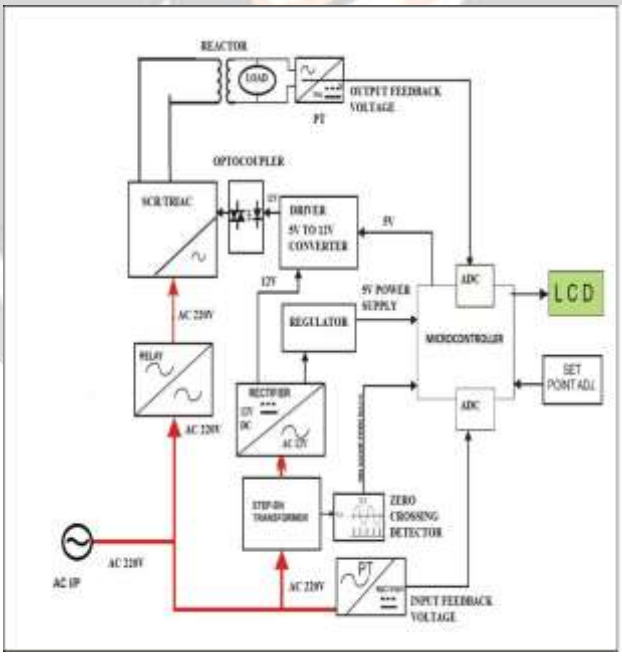

Fig. Block Diagram Adaptive PI control of STACOM for voltage regulation

Operation of block diagram:

In the above block the main aim is to control and keep balance the voltage across load .Initially controller check the incoming voltage coming from line with the help of ADC (analog to digital converter) present inside the Microcontroller. Our aim is to control a positive as well as negative half cycle of incoming AC for that a Firing angle control method is used. or controlling a firing angle of any AC voltage it is necessary to monitor every positive or negative half cycles, hence a Sine Wave Cycle Monitor (Zero Crossing Detector) block is used in our project, which informs a controller about start point of every cycle. Once controller knows the voltage across the load and signals from sine wave cycle monitor, controller calculate the firing angle and gives firing pulse to the AC to AC converter in which

a static switch formed by a SCR/TRIAC is used. Static switch can operated on high voltage and high frequency as compare to the mechanical switches like relay.

Potential transformer is used to step down the voltage across the load to be measure and rectified to DC, because microcontroller can read a voltage upto 5vdc only. In our project we are using a **Relay** for tripping the input voltage in case of very high voltage and low voltage which is beyond control-able limits. The relay used in our project is of 12 volts and controller can give maximum of 5v.

It is necessary to amplify the 5v to 12v for which a Driver circuit is used. Microcontroller requires a 5 v DC to work, and same will be generated with the help of Power Supply which comprises of a Step down transformer, rectifier, filter and regulator. Transformer step down the 220 v AC to 12vAC, rectifier and filter converts this 12 v AC to 12 v DC, and regulator converts a 12 v DC to a constant of 5 v DC.

5. MATERIAL

5.1 The Full Wave Rectifier (12VAC to 12VDC): - A Full Wave Rectifier is a circuit, which changes over an air conditioner voltage into a throbbing dc voltage utilizing both half cycles of the connected air conditioning voltage. It utilizes two diodes of which one behavior amid one half cycles while alternate behaviors amid the other half cycle of the connected.

5.2 Voltage Regulator (12VDC to 5VDC): - A voltage controller is intended **to** consequently keep up a consistent voltage level, where they settle the DC voltages utilized by the processor and different components.

5.3 Sine wave cycle monitor (ZERO CROSSING DETECTOR): - A zero intersection locator is a one sort of voltage comparator, used to distinguish a sine waveform progress from positive and negative, that concurs when the I/p crosses the zero voltage condition. In rotating current, the zero-intersection is the immediate time when there is no voltage exhibit. In a sine wave or other basic waveform, this regularly happens twice amid each cycle.

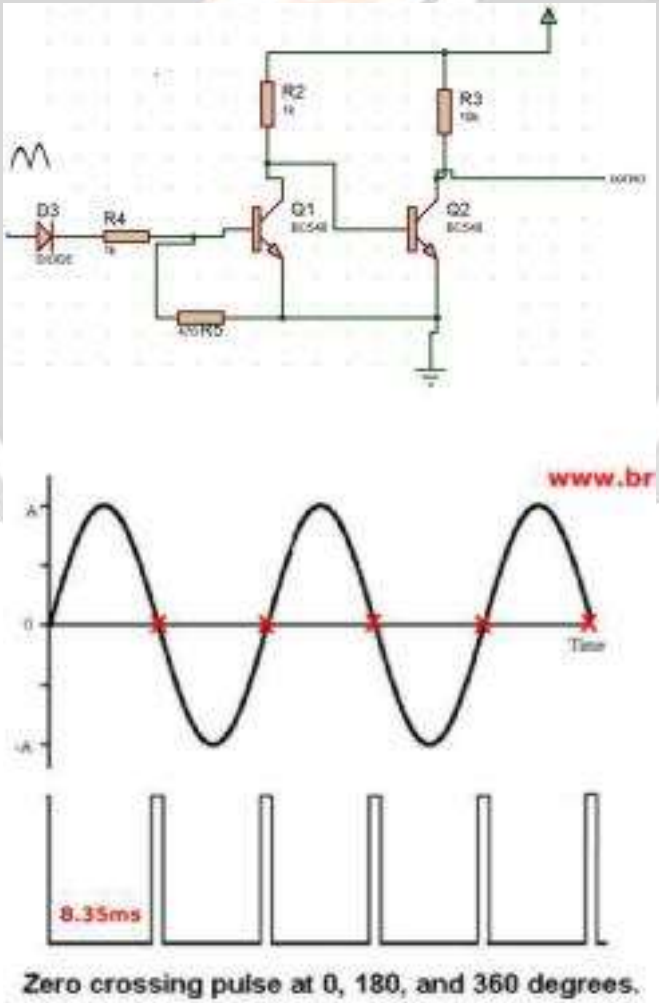

Fig.3 Zero crossing detector

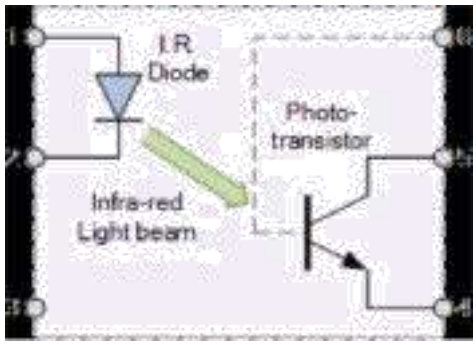

Fig. Opto-coupler

5.4 DRIVER: -

A Microcontroller advanced rationale yield stick supplies just 10mA of current. Outer gadgets, for example, high-control transfers can require >100mA and they require more voltages. With a specific end goal to control such gadgets which utilize high DC ebb and flow, a transistor-based driver circuit is utilized to enhance ebb and flow to the required levels. On the off chance that the voltage and current levels are in consummate range, the transistor demonstrations like a high-current switch controlled by the lower current computerized rationale flag.

5.5 Opto-coupler and driver: An opto-coupler are intended to give finish electrical confinement between an info low voltage side(controller side) and yield high voltage side (SCR/TRIAC side) circuits.

5.6LCD: LCD (Liquid Crystal Display)

Screen is an electronic show module and locate an extensive variety of uses.

5.7 THYRISTOR/TRIAC: These are Static gadgets used to switch. Static gadget is a sort of gadget which changes over one kind of vitality or vitality level in to another kind of vitality or vitality level individually without physical m

Fig. Experimental setup

6. CONCLUSION

In this new control model based adaptive PI control which can adjust the control gains during the disturbances. Hence it can provide fast and efficient voltage. By static synchronous compensator to control. The reactive power to improve the voltagestability of Power system.

REFERENCES

1.Maria Hanley, Jovan Ilic, "Frequency InstabilityProblems in North American Interconnections," DOE/NETL-2011/1473, Jun 2011.

2.A.H.M.A. Rahim, E.P. Nowicki, and J.M. Bakhashwain, "Fuzzy STATCOM Control Strategies for Power System Stabilization," ICGST International Journal on Automatic Control and Systems Engineering, ACSE, pp. 41-48, Feb. 2006.

3.Rao P, Crow M.L, and Yang Z, "STATCOM control for power system voltage control applications, "IEEE Trans. Power Del., 15 (4), 2000, 1311–1317.

4. Xu, Q. Hu, and F. Li, "Probabilistic model of payment cost minimization considering wind power and its uncertainty," IEEE Trans. Sustain.Energy, vol. 4,no. 3, pp. 716-724, July 2013.

5.S. Dahal, N. Mithulananthan, T. Saha,"Investigation of small signa stability of a renewable energy based electricity distribution system," IEEE PES General Meeting, Minneapolis, Minnesota, 2010.