Power Quality Enhancement Using Voltage Regulator in Low Voltage Distribution Grids

Prof. V. A. Bagali [1] Veena Nadagouda [2]

Asst professor [1] M.Tech student [2]

[1,2]Department of Electrical & Electronics Engineering, BLDEA's CET Vijayapur, KARNATAKA INDIA

ABSTRACT - This paper describes Power quality enhancement using voltage regulator in low voltage distribution grids.The DSTATCOM is created to connect the low voltage grid, to solve regulation problems. The usage of DISTRIBUTION STATCOM (DSTATCOM) it's far feasible to lessen the voltage fluctuations like sag and swell conditions in distribution systems.The Simulation results has been carried out using MATLAB SIMULINK.

Key words*: Power quality enhancement, Voltage Regulator, Minimum power point tracking.*

2. INTRODUCTION

Costumers connected on the last part for voltage supply might encounter bad voltage regulation, as stated by brazilian grid code vitality offices need limited the long run breaking points on repair shed the voltage degrees in those side of the point for regular coupling ,if those voltages would out of entryways the permissible degrees. Those time needed for everlasting answers, in grid restructuring ,capacitor banks situated up, with be operational might additionally surpass the cut-off dates, inside the case for disappointment to help those time limits, the quality endeavor need with discount each benefactor in the circulation grid framework throughout the the long haul that poor voltage regulation not tolerated. Pointing on control refunds, an voltage controller might make utilized likewise an transient reply. Those voltage controller must need quick voltage regulation.Utilizing the recommended solution, those grid power pleasant will be reestablished and the side of the point for basic coupling voltage is recapture over a transient.

In the meantime, the everlasting response might a chance to be planned furthermore snared dependent upon in the perfect time allotment likewise quickly as the positive result is set up of the voltage controller can a chance to be disengaged starting with the grid what's more associated with diverse grid for beat the issues.

In a distribution system, as shown in Fig. 1. It consists of a stiff supply related at bus 1 and three load buses. it's far assumed that consumers are furnished from those buses. A DSTATCOM may be linked in any of these buses, depending on whether it belongs to the application or a particular consumer.

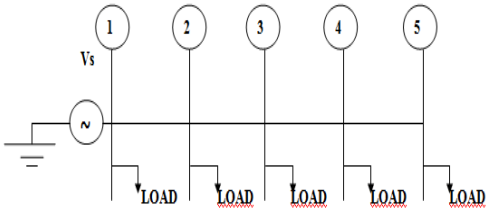


Fig 1: Distribution System

If the voltage at bus three is disconnected, it affects consumers each at buses three and 4. The application may then installation a DSTATCOM at this bus to clean up its voltage. On the other aspect, think that the purchaser at bus 4 has hundreds that draw unbalanced and distorted modern-day from the supply. as a way to keep away from a terrible voltage law, one choice for the consumer is to install a DSTATCOM on its premises, so that the current drawn from bus four is balanced sinusoid.

3. DSTATCOM OPERATION

A Distribution Static compensator (DSTATCOM), a custom electricity device, related in shunt with the burden, compensates for the reactive strength and unbalance caused by numerous loads inside the distribution machine. The manipulate strategies for voltage regulation, energy aspect improvement and compensation of unbalanced systems, for a DSTATCOM, are defined.An DSTATCOM is a shunt recompense gadget that gives a powerful result for sensitive quality reimbursement rate furthermore voltage regulation.It suits of a Voltage source converter (VSC), an dc capacitor, a coupling inductor or coupling transformer additionally an controller, as turned out in Fig 2.

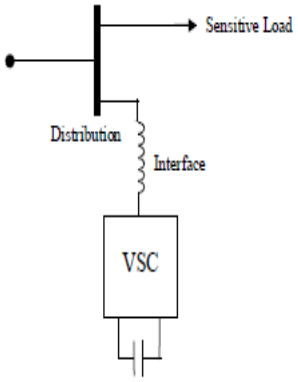
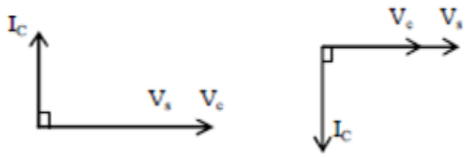


Fig 2:DSTATCOM



a. Capacitive mode b. Inductive mode

c. Floating state

Fig 3: DSTATCOM operating modes

The DSTATCOM, identified with the grid through the coupling inductor in the purpose from claiming basic coupling (pcc), will be figured out how in this sort that it exchanges handiest sensitive quality with those grid. If the vitality of the DSTATCOM voltage Vc may be additional over those grid voltage Vs (Vc >Vs), those DSTATCOM components sensitive power of the grid, likewise demonstrated in Fig 3a, and the DSTATCOM may be operating inside those capacitive mode. Whether those grid voltage will be more than the DSTATCOM voltage (Vs > Vc), the DSTATCOM absorbs sensitive quality starting with those grid, Concerning illustration demonstrated on Fig 3b, and the DSTATCOM may be operating inside the inductive mode. On those grid voltage and the DSTATCOM voltage are of the indistinguishable twin noteworthiness (Vs =Vc), there may be no profession about sensitive control around those grid and the DSTATCOM, Concerning illustration indicated for Fig 3c.

4. MINIMUM POWER POINT TRACKING

The voltage amplitude to make directed toward pcc adjustments the power try for those stream Around the grid, load, and DSTATCOM. Suitableness VPCC makes those transformed clear quality be least. Whilst those VPCC may be the middle of the favored voltage limits, those mPPT minimizes those converter clear energy also no sensitive control in those grid recurrence is transformed.

Perturb-and-Observe

(P&O)- Based mppt Algorithm

The P&O based minimum electricity factor set of rules is based on the following criterion: if the running voltage of the PV array is perturbed in a given path and if the energy drawn from the PV array will increase, because of this the working factor has moved towards the MPP and, therefore, the running voltage ought to be similarly perturbed inside the same direction. in any other case, if the energy drawn from the PV array decreases, the working factor has moved faraway from the MPP and, consequently, the course of the working voltage perturbation ought to be reversed.

5. METHODOLOGY

To increases the overall performance of power in distribution grid device. DSATCOM changed into connected to the distribution grids. DSATCOM turned into designed the use of MATLAB SIMULINK. The DSTATCOM consists in a 3phase 4-wire Voltage source Inverter (VSI) linked to the grid via a 2nd order low pass filter.

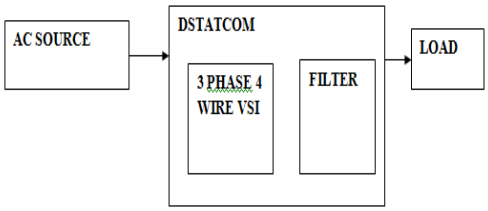


Fig 4: Block diagram

- ❖ Studied to be carried out DSATCOM built voltage controller over low voltage distribution grids.
- ❖ Making the voltage regulation module utilizing MATLAB SIMULINK.
- ❖ Analyzing the waveforms for linear load and nonlinear load.

6. SIMULATION MODULES

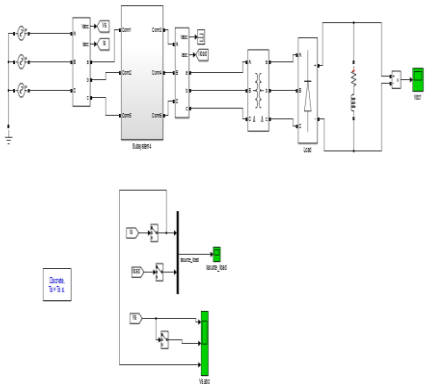


Fig 5: Voltage regulator

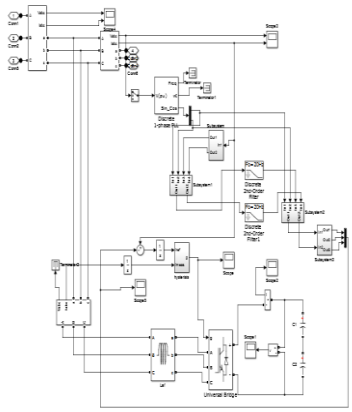


Fig 6: Subsystem4 consists Subsystem and Subsystem 1,2,3.

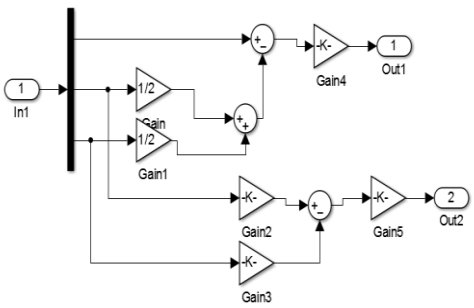


Fig 7: Subsystem

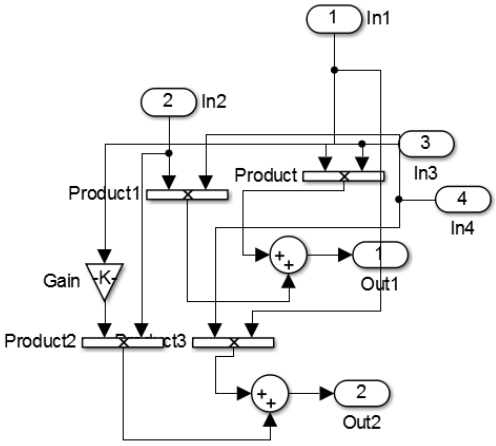


Fig 8: Subsystem1

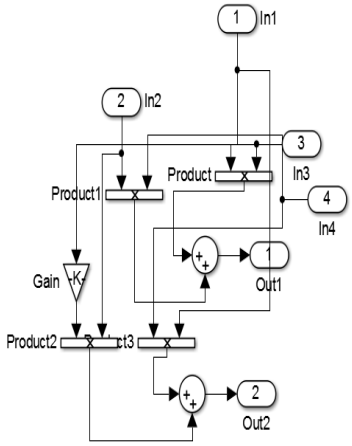


Fig 9: Subsystem2

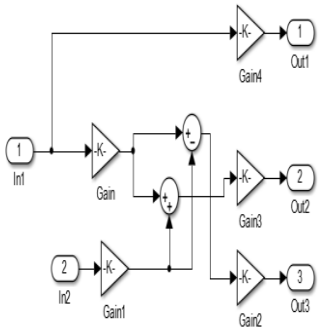


Fig 10: Subsystem3

7. SIMULATION RESULTS

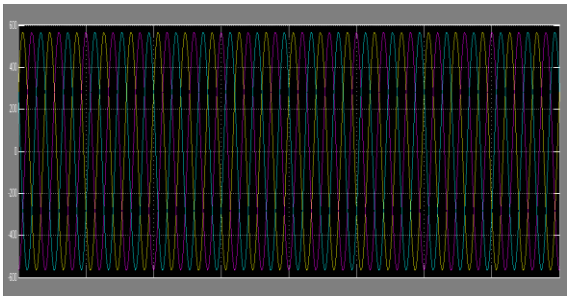


Fig 11: Without compensation voltage waveform for linear loads.

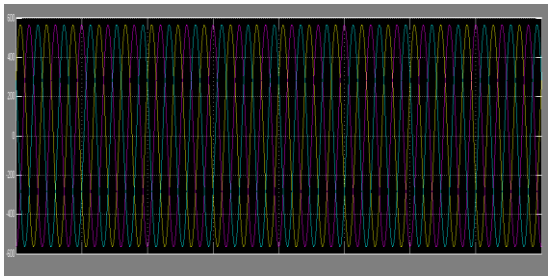


Fig 12: For linear loads With compensation voltage waveform.

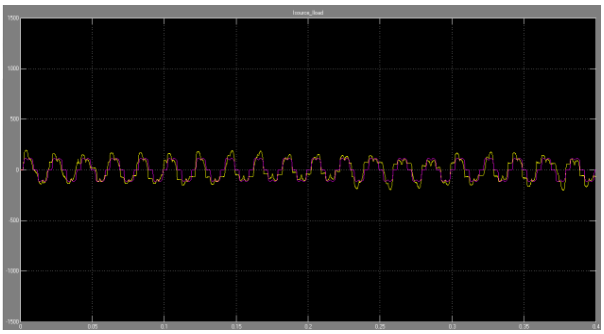


Fig 13 : For linear load voltage regulation.

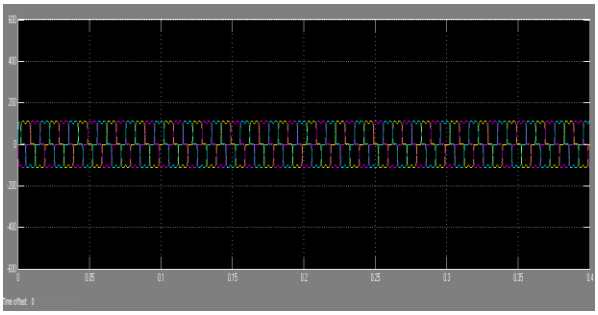


Fig 14: Minimum power point tracking voltage regulation linear loads

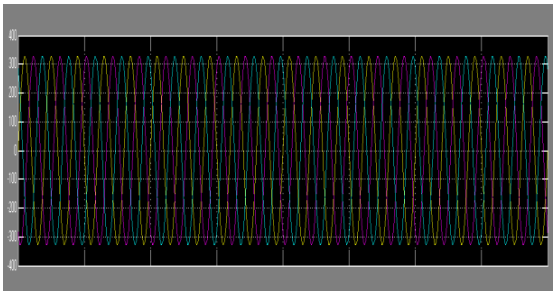


Fig 15: Without compensation voltage waveform for nonlinear loads.

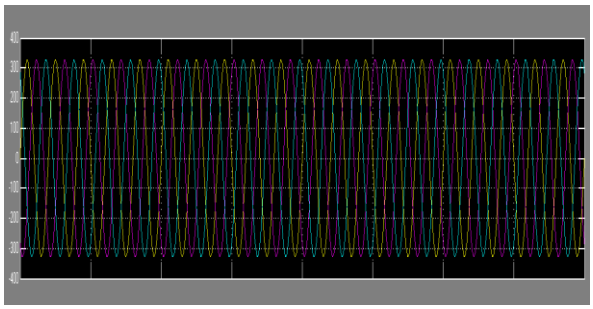


Fig 16: With compensation voltage waveform for nonlinear loads

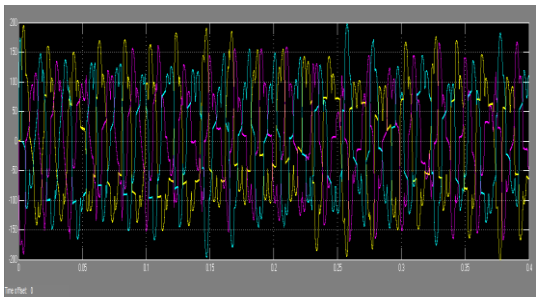


Fig 17: Nonlinear loads voltage regulation.

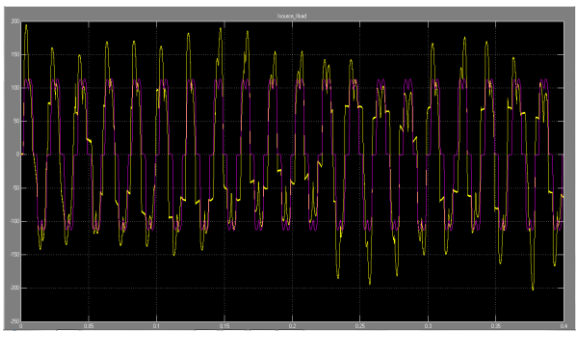


Fig 18: Minimum power point tracking voltage regulation nonlinear loads.

8. CONCLUSION

This paper presents Power quality enhancement using voltage regulator in low voltage distribution grids.Using MATLAB SIMULINK Simulation results of voltage regulation waveforms and voltage regulation with minimum power point tracking for linear loads and nonlinear loads has been analysed. Design has been carried out for simulation modules for voltage regulator using MATLAB SIMULINK.Analysed waveforms for regulation capacity,linear and nonlinear loads.

REFERENCES

[1] ANEEL National Electric Power Distribution System Procedures – PRODIST, Module 8: Energy Quality. Revision 07, 2014.

[2] M. Mishra, A. Ghosh and A. Joshi, "Operation of a DSTATCOM in voltage control mode," IEEE Trans. Power Del., vol. 18, no. 1, pp. 258-264, Jan. 2003.

[3] G. Ledwich and A. Ghosh, "A flexible DSTATCOM operating in voltage or current control mode," IEE Proc.-Gener., Transmiss. Distrib., vol. 149, n. 2, pp. 215-224, Mar. 2002.

[4] T. P. Enderle, G. da Silva, C. Fischer, R. C. Beltrame, L. Schuch, V. F. Montagner and C. Rech, "D-STATCOM applied to single-phase distribution networks: Modeling and control," in Proc. IEEE Ind. Electron. Soc. Annu. Conf., Oct. 2012, pp. 321 - 326.

[5] C. Kumar and M. Mishra, "Energy conservation and power quality improvement with voltage controlled DSTATCOM," in Proc. Annu. IEEE India Conf., Dec. 2013 pp. 1-6.

[6] R. T. Hock, Y. R. De Novaes and A. L. Batschauer, "A voltage regulator based in a voltage-controlled DSTATCOM with minimum power point tracker," in Proc. IEEE Energy Convers. Congr. Expo., Sep. 2014, pp. 3694-3701.

[7] B. Singh, R. Saha, A. Chandra and K. Al-Haddad, "Static synchronous compensators (STATCOM): a review," IET Power Electron., vol. 2, no. 4, pp. 297-324, Jul. 2009.

[8] C. Kumar and M. Mishra, "A Multifunctional DSTATCOM Operating Under Stiff Source," IEEE Trans. Ind. Electron., vol. 61, no. 7, pp. 3131-3136, Jul. 2014.

[9] C. Kumar and M. Mishra, "A Voltage-Controlled DSTATCOM for Power-Quality Improvement," IEEE Trans. Power Del., vol. 29, no. 3, pp. 1499-1507, Jun. 2014.

[10] S.-H. Ko, S. Lee, H. Dehbonei and C. Nayar, "Application of voltage- and current-controlled voltage source inverters for distributed generation systems," IEEE Trans. Energy Conv., vol. 21, no. 3, pp. 782-792, Sep. 2006.

[11] Rubens Tadeu Hock Jr.,Student Member IEEE, Yales Rômulo de Novaes, Member, IEEE, Alessandro Luiz Batschauer, Member IEEE, "A Voltage Regulator for Power Quality Improvement in Low-Voltage Distribution Grids".