ISSN PRINT 2319 1775 Online 2320 7876
Research paper UGC CARE Listed (Group -I) Journal Volume 10, Spl Iss 2, 2021

Analysis of a Dstatcom-based sliding mode controller for distribution system power quality enhancement

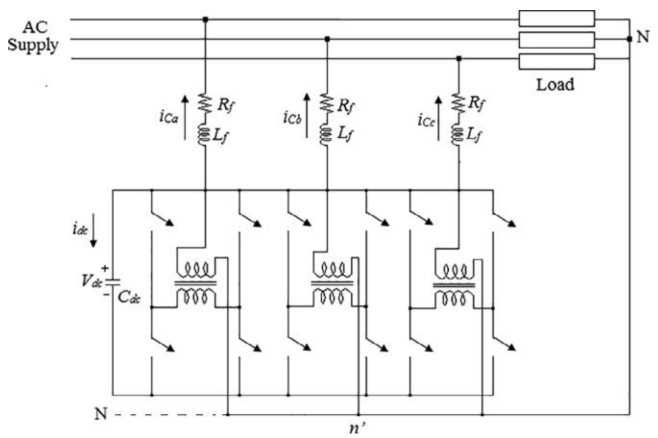
R.Bhanu Raghava Prakash

[1]Department of Electrical and Electronics Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, Andhra Pradesh, India 522502. bhanu184@kluniversity.in

Abstract

In this paper, a Distribution Static Compensator (DSTATCOM) based on Sliding Mode Controllers is dev eloped for improving power quality in the distribution network.
A quick change in voltage occurs in the DC link capacitor voltage connected to the compensating device durin g load disturbances in the systems.The capacitor voltage level during load change is the only factor that influe nces DSTATCOM performance.
It ought to be kept within the permitted bounds.Typically, the converter's conventional controller is utilized to regulate the voltage of the dc-link capacitor.
However, the transient reaction of a traditional controller like PI is still slow.The harmonic removal, thus,Whe n there are different load changes in the distribution systems, load balancing and reactive power compensation processes are not suitable.In the control circuit for the appropriate operation of the compensator, a sliding mo de controller is suggested as a solution to these issues.The DC link capacitor voltage is controlled by the slidin g mode controller to produce the necessary reference currents.For switching pulse generation and DSTATCO M management under diverse load disturbances, reference currents are crucial.The purpose of a sliding mode controller is to keep variations in DClink voltage to a minimum.The results of modeling and simulating the pr oposed technique's performance on the MATLAB/SIMULINK platform are used to validate the design and co ntrol of DSTATCOM under a variety of load disturbances.

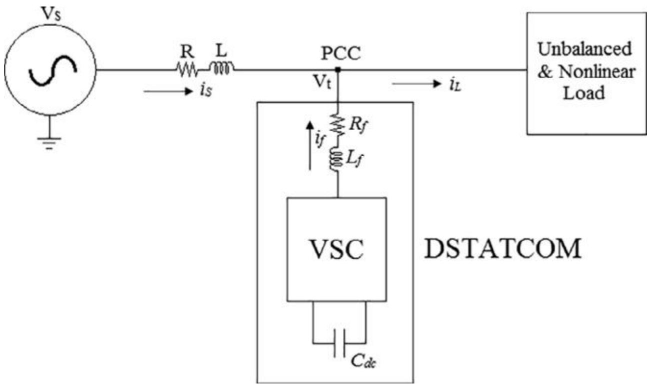
System configuration



. A distribution line with DSTATCOM connected at PCC

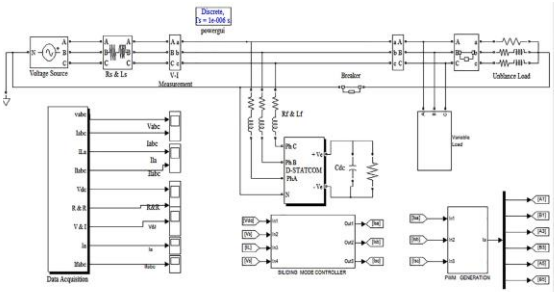
ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Spl Iss 2, 2021

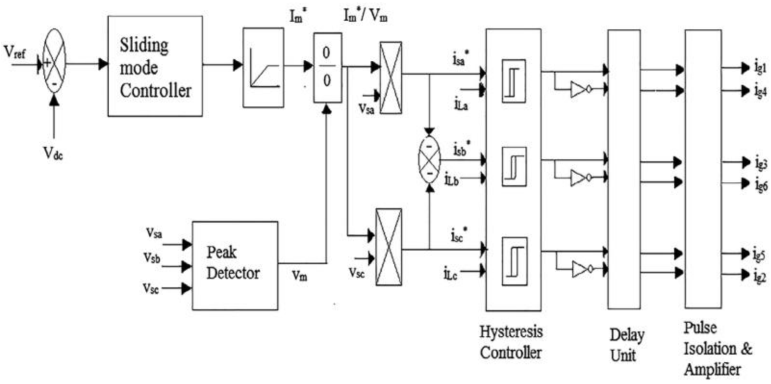


DC-Link voltage regulation method

By regulating the converter capacitor voltage and reference source current is calculated [1]. Here, the error detector estimates the error then it is processed through a controller and the instantaneous currents are estimated [2].



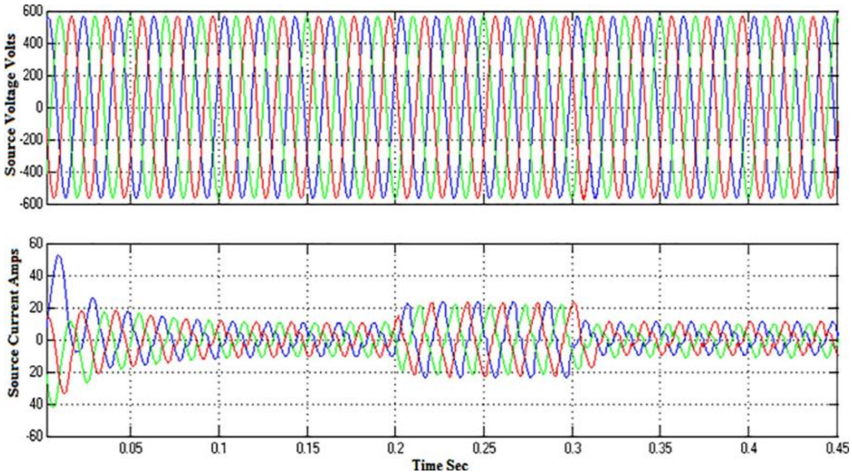
2. Design of sliding mode controller



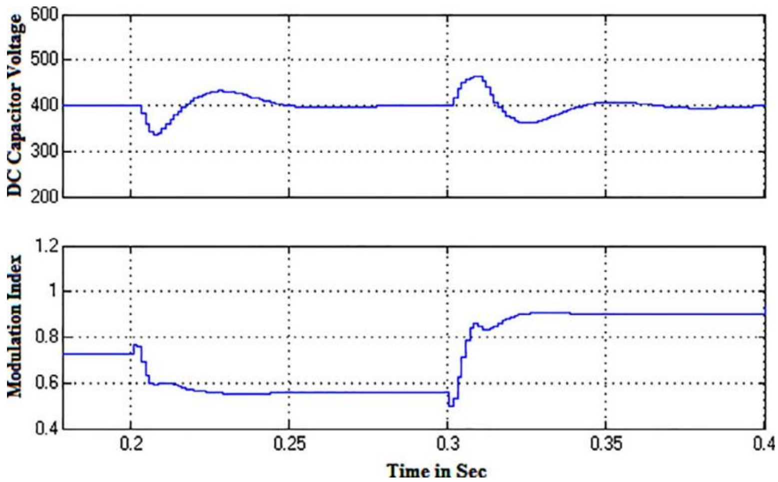
ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 10, Spl Iss 2, 2021**

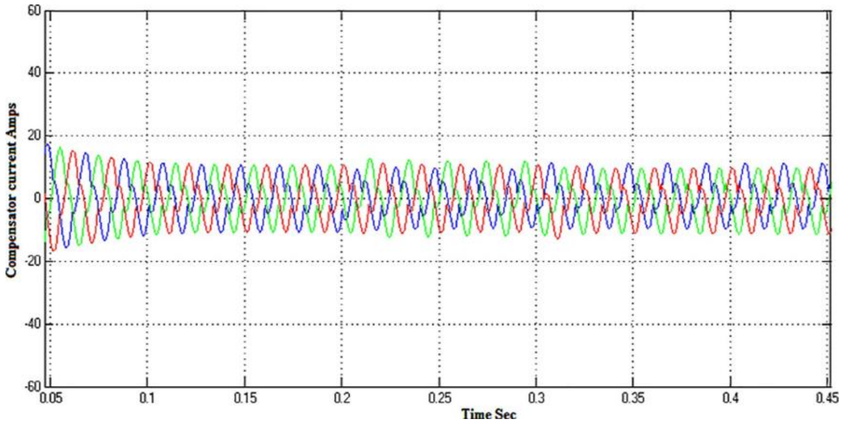
Source voltage and source current



DC Link voltage



Compensation current



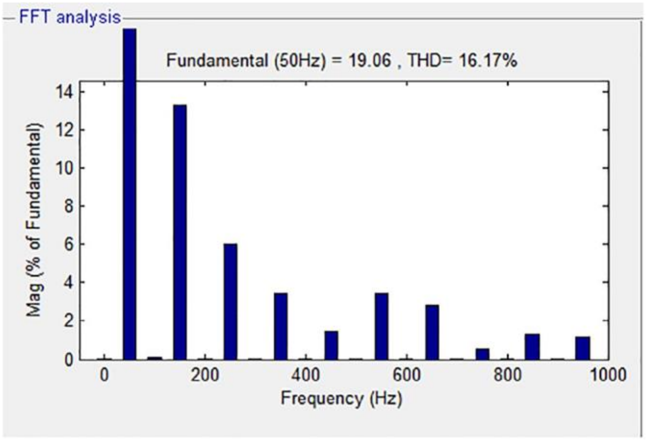
Simulation Results

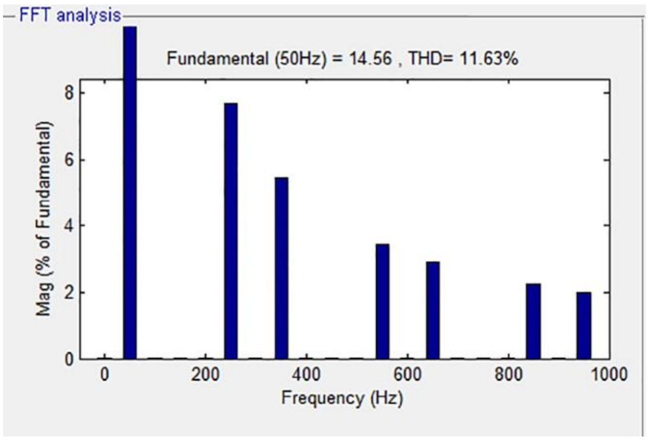
ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 10, Spl Iss 2, 2021**

DYNAMIC RESPONSE OF STATCOM

Load current THD before compensation [3]. b. Load Current THD after Compensation.

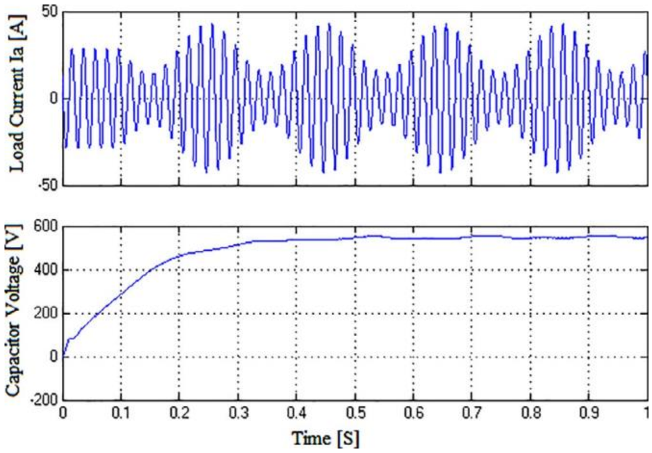




Variable load current and capacitor voltage

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 10, Spl Iss 2, 2021**



Conclusions

The reference currents are estimated by controlling the capacitor voltage using a sliding mode con troller, the dclink voltage is managed when the load changes as well as when the supply voltage is dist orted and imbalanced.The DSTATCOM control approach is effective in removing harmonics and reac tive power components from utilities while maintaining sinusoidal line current, and it performs satisfa ctorily in this regard.The simulation results demonstrate the sliding mode control's efficacy in maintai ning dclink voltage within the established bounds and minimizing harmonics introduced into the syste m by the load.The switching frequency at the application step is kept within the upperlimit established by switching mechanisms. Last but not least, the DSTATCOM based on Sliding Mode Controllers enhances the quality of power in the distribution system with fluctuating loads.

References

[1] M.H.J. Bollen, Understanding Power Quality Problems, IEEE Press, New York, 1999.
[2] A. Moreno-Munoz. Power Quality: Mitigation Technologies in a Distributed Environment Springer, London (2007).
[3] H. Akagi, Control strategy and site selection of a shunt active filter for damping of harmonic propagation in power distribution systems, IEEE. Trans. Power Delivery 12 (1) (1996) 354–363.