Power Quality Improvement of Grid Connected Inverter using DSSC

Supriya Sunil Kadam, Yuvraj Krishnarao Kanse

Abstract: ***In most of the distribution systems, major issue named as Power quality is concern. Maximum power quality problems including harmonic compensation, voltage sags and voltage flickers are mitigating using Distributed Flexible Alternating Current Transmission System (D-FACTS) Devices. Distribution Static Series Compensator (DSSC) is one of the DFACT devices. The Simulation and modeling of DSSC for grid connected inverter with power quality improvement is presented here. Also, complexity and cost can be reduced by using Distributed Static Series Compensator (DSSC). More capabilities are posses by the same. MATLAB SIMULINK model is presented in this paper with results and discussion. Here, Total Harmonics Distortion is calculated with & without DSSC.***

Keywords: Inverter, D-FACTS, DSSC, THD

I. INTRODUCTION

Now days, Power Quality is major concern for electricity distribution. Major importance goes to cost effective control of power quality with less complexity. It is necessary to handle the Harmonics components with maximum Active Power. Reactive power can be minimized to improve power quality specifications. Power Transfer capability & controllability can be enhanced by using various Flexible Alternating Current Distribution System (FACTS). Distributed FACTS devices are extended version of FACTS devices which are capable to provide flexible solution with less cost & complexity.

DSSC is effective power flow controller in cost effective & reliable way in distributed manner. SSSC is help to cover the active and reactive power demand. In interconnected distribution network, Load balancing is done. Controllability & power utilization of DSSC is more. DSSC can be connected at different places of transmission line.

Flexibility & Reliability of DSSC is more as compared to SSSC. DSSC is advanced version of SSSC. Power quality can be improved with the help of insertion of DSSC in transmission line at different places during the transmission. This device is helpful to reduce the Total THD and improve the active power quantity. Reactive power can be reduced with Increase in the Power factor [1]-[10].

Further, SIMULATION model is discussed in the next part of paper. Results in the form of THD, Error voltages, Utilized and Unutilized power etc. are expressed at the end of paper.

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II. PROPOSED WORK

Distributed Flexible Alternating Current Transmission System (D-FACTS) for Grid connected inverter provides the power factor improvement, minimization of harmonics and voltage stability. Where intelligent power quality monitoring and improvement can be achieved via the usage of Distributed FACTS, controller and control algorithm along with embedded devices, through rigorous literature review the following work is proposed. By using Distributed Flexible Alternating Current Transmission System (D-FACTS) with grid connected inverter, system can control harmonics distortion, improve the power factor and voltage stability. In this system, controller will control the power quality with the help of control algorithm. Distributed Flexible Alternating Current Transmission System (D-FACTS) plays vital role in power quality improvement.

The grid connected inverter will be deployed in order to improve power quality. Distributed Flexible Alternating Current Transmission System (D-FACTS) can be utilized to improve the voltage stability and reduce the disturbances in distribution system. Power factor enhancement and minimum losses across load can be achieved using this technique. This may be the case, for a low-cost intelligent system where reasonable performance must be obtained by using Distributed Flexible Alternating Current Transmission System (D-FACTS) for grid connected inverter with improved power quality. The signal conditioning circuit will provide the signal to grid tied inverter. Due to this inverter will operate in suitable conditions. Inverter will operate over the control algorithm decided by controller. Control action regarding power quality of grid connected inverter will taken by the controller. Distributed Flexible Alternating Current Transmission System (D-FACTS) will improve the quality of power of grid connected inverter.

III. EXPERIMENTATION

Power quality improvement of grid connected inverter can be improved by using DFACTS devices. Here, one of them is used for the same purpose. DSSC is available as better solution in distribution network, which having various advantages as compared to other. Fig.1. shows MATLAB simulation model for proposed work. Inverter parameter can be controlled by using DSSC. During the long distance transmission, DSSC connects across to the inverter, so that it will control the power flow & improving the power transfer capability. Switch is used to

connect the DSSC to transmission line; it can control the loop mechanism. Power Factor, Active power & Reactive power are measured & displayed in MATLAB/SIMULINK. The difference between mentioned parameters for with & without DSSC is compared here.

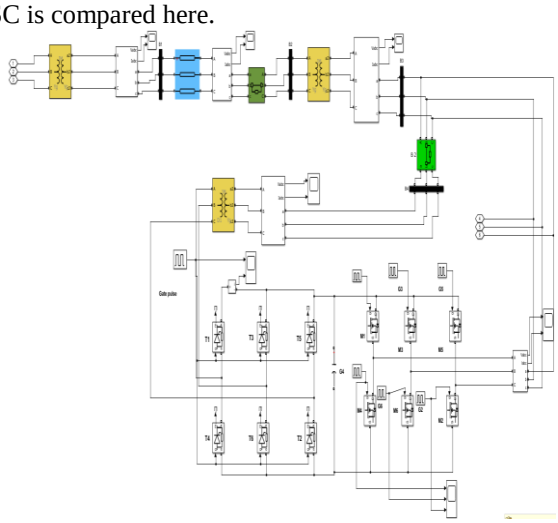

Fig.1. MATLAB Simulation model for proposed work

IV. RESULTS AND DISCUSSION

In experimentation, Simulation is compared results for both cases such as with & without DSSC analysis. Inverter with DSSC & without DSSC represents close loop & open loop respectively. In open loop case, DSSC disconnects from the inverter, hence effect of this device is available on power factor & Active-reactive power values. Power factor is displayed as 0.8039, whereas Reactive & Active power is available such as 498851.51 watts & 677433.50 watts respectively.

In closed loop, when DSSC connects to the inverter it will control the power flow & provides the power factor approximately 0.99, whereas Reactive & Active power is available such as 7163.35 watts & 752298.70 watts respectively.

In Fig.2. Open loop output is represented. Without DSSC, Total Harmonic Distortion (THD) is compared for 20 cycles & 6 Cycles Respectively. Fast Fourier Transform (FFT) window shows THD for both the cases. For 20 Cycles, THD is 13.80 % and for 6 cycles THD is 3.05%. Both conditions operates over the Fundamental frequency 50 Hz. Fundamental frequency components magnitude for 20 cycles & 6 Cycles are 432.5 & 348.1 respectively.

In Fig.3. Close loop output is represented. With DSSC, Total Harmonic Distortion (THD) is 9.54 % is for 20 Cycles and 0.05% for 6 cycles. Both conditions operate over the Fundamental frequency 50 Hz. Fundamental frequency components magnitude for 20 cycles & 6 Cycles are 480.9 & 412.9 respectively.

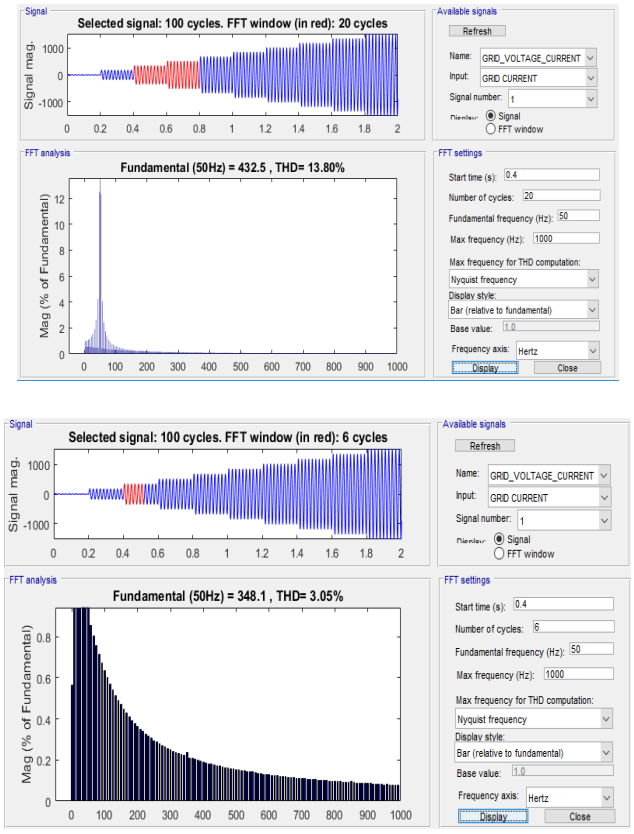

Fig.2. Open Loop Output

In distribution system the distribution networks and sensitive industrial loads are suffering from different type of outage and interruption which can lead to loss in production and other measurable and non measurable factor. The factors that are affecting on power quality are voltage sag, voltage variation, interruption, swells, brownout, distortions, Harmonic, noise, voltage spikes, voltage flicker etc. This causes some deviations in the power when compared with the normal standards. The above problems may overcome by using compensation devices (custom power devices) either compensate load i.e. correct its power factor, unbalance etc. or improve the quality of the supply voltage. The power factor improvement for grid connected inverter can be obtaining using Distributed Flexible Alternating Current System. To obtain better performance this can be simulated by using MATLAB.

Table.1.represents the comparision of Characterisstics inverter with and without DSSC.

Sr. No.	Parameters	Without DSSC	With DSSC
1	Power Factor	0.8039	0.99
2	Active Power	498851.51 watts	752298.70 watts
3	Reactive Power	677433.50 watts	7163.35 watts
4	THD for 20 Cycles	13.80 %	9.54 %
5	THD for 6 cycles	3.05%	0.05%

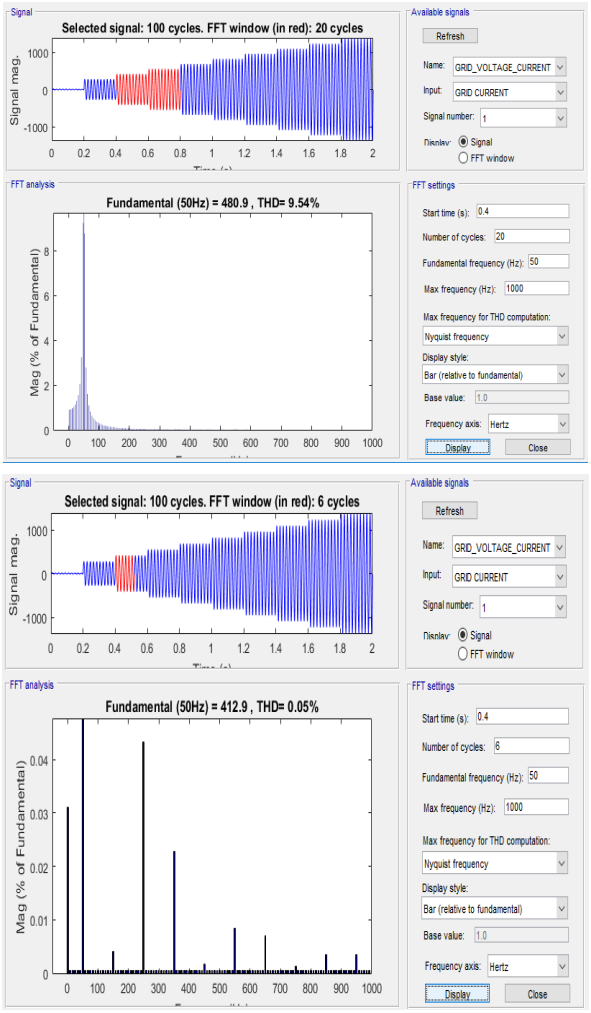

Fig.3. Close Loop Output

V. CONCLUSION

D-FACTS devices provides more flexibility, controlaibilty, Power utilization & Reliabilty. DSSC device provides the power flow control during the distribution over transmission line. Power factor is improved from 0.80 to 0.99. Active power is incresed & Reactive power is minized with DSSC. THD is reduced with the use of DSSC. Waveform shapes are retrived & provides smoothness in case of DSSC interfacing.Voltage sag & swell aslo minimized here. Frequency components are provides less variation when inverter is connectes to DSSC.

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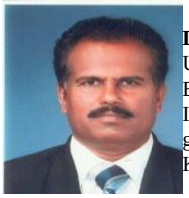

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