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Utilize Distributed Power-Flow ControllerTo Compensate Unbalanced Voltage In Nine Bus System

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ABSTRACT: Flexible AC Transmission System is used to control the power flow and also to compensate the voltage sag in the transmission system. High cost and reliability limited the use of facts. This paper introduces the concept of Distributed FACTS (D-FACTS) as an alternative approach to realizing cost-effective power flow control. The DPFC is derived from the unified power-flow controller (UPFC). The DPFC can be considered as a UPFC with an eliminated common dc link.By way of example a dynamic voltage regulator (DVR) and a static compensator (STATCOM) are shown that can be clipped on to an existing power line and can compensate the unbalanced voltage, real and reactive power in the grid. The objective of this work is to improve the real and reactive power by employing DPFC. Nine bus system with line interruption with and without DPFC are simulated then the result of voltage sag compensation, real power and reactive power are compared and tabulated using MATLAB/Simulink and the simulation results are presented.

KEYWORDS: Pulse Width Modulation(PWM), Distributed Static Compensator(DSATCOM),Dynamic Voltage Regulator(DVR),UPFC,DPFC,VSC.

I.INTRODUCTION

The Unified Power Flow Controller (UPFC) was introduced forreal-time control and dynamic compensation of ac transmission **sys**tems, which solves many problems faced in the utility industry. The UPFC consists of a static synchronous compensator (STATCOM) and a static synchronous series compensator (SSSC), which are coupled via a common dc link, to allow bidirectional flow of active power between the series output terminals of the SSSC and the shunt output terminals of the STATCOM This arrangement functions **as** an ideal acto acpower converter in which the real power can freely flow in eitherdirection (bidirectional) between the ac terminals of the two converters.The reactive power is generated internally by the static synchronous series converter (SSSC) and the active power is supplied by the shunt converter that is back-to-back connected. A single series converter is connected to the transmission line, hence it has lower reliability and high cost due to dc link.

II.SYSTEM DESCRIPTION

A Static Compensator (STATCOM) is used in transmission system for the compensation of reactive power and also to reduce harmonics. STATCOM is connected in parallel with transmission lines. For example while we are transmitting 1000 kv through transmission lines, and at the receiving end we get only 800kv due to losses. The losses may be reactive power, voltage sag and harmonics. So we use STATCOM for reactive power compensation and also mitigate the voltage fluctuations. Along with Pulse Width Modulation (PWM), the Voltage Source Converter (VSC) mitigate the voltage fluctuations fastly. To mitigate harmonics, power quality improvement and reactive power compensation in distribution system the STATCOM is used.

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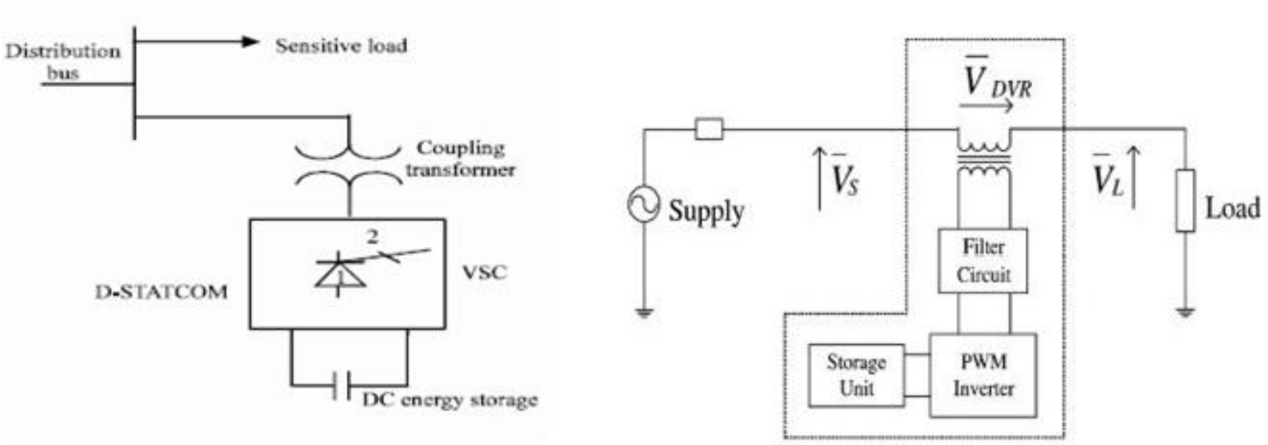

Fig 2.1.Block Diagram OfSTATCOM And DVR

A Dynamic Voltage Restorer (DVR) is a series connected solid state device that injects voltage into the system in order to regulate the load side voltage. It is normally installed in a distribution system between the supply and the critical load feeder. In the event of a disturbance, in order to avoid any power disruption to that load DVR is used to boost up the load-side voltage. The main task provided by the DVR is voltage sags and swells compensation. In addition to that, the DVR have other features such as: line voltage harmonics compensation, reduction of transients in voltage and fault current limitations. The general configuration of the DVR consists of a voltage injection transformer, an output filter, an energy storage device, Voltage Source Inverter (VSI), and a Control system as shown in Figure3.1.

Fig 2.2 Block Diagram Of Existing Model

The fig 2.2 shows the block diagram of the existing model of DPFC in two bus systems.

Fig 2.3 Block Diagram Of The Proposed Model

The fig 2.3 shows the block diagram of the proposed model of DPFC in nine bus systems.

III.SIMULATION RESULTS

In the fig 3.1 shows the Simulink model of nine bus system without DPFC. The results are shown below and the comparison between the output voltage,real power and reactive power.

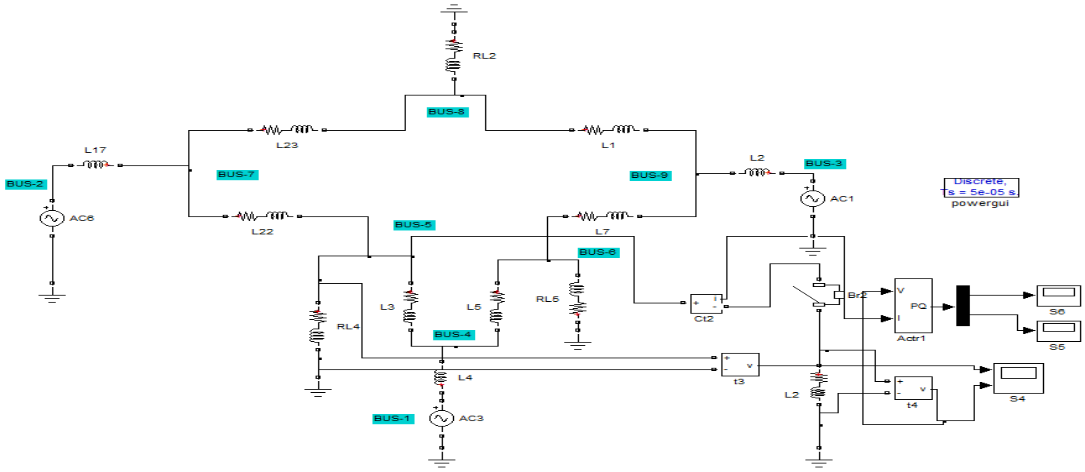

Fig 3.1 SimulinkModel Of Nine Bus System Without DPFC

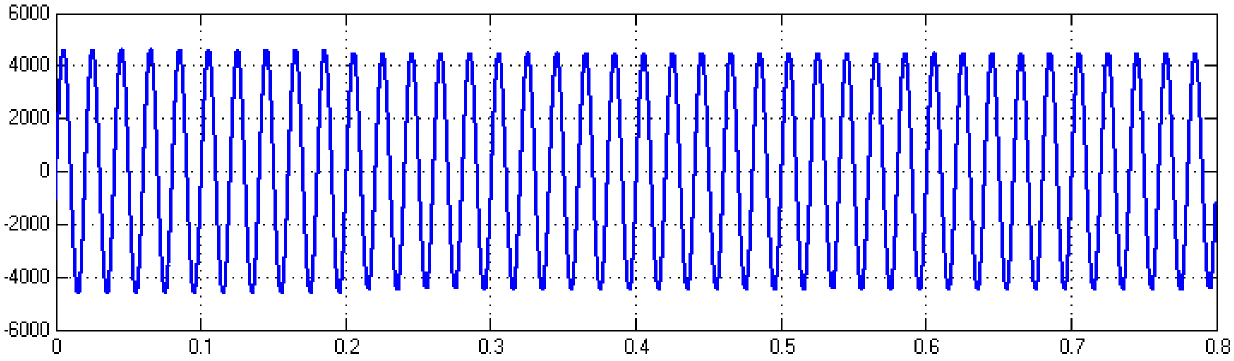

Fig 3.2 Simulation Output Voltage Of Nine Bus System At Bus-5

The simulation of the output voltage of nine bus system at bus -5 is shown in fig 3.2 ,where the voltage is in the peak of 5000KV.There is a variation of voltage at the time interval 0.2s.

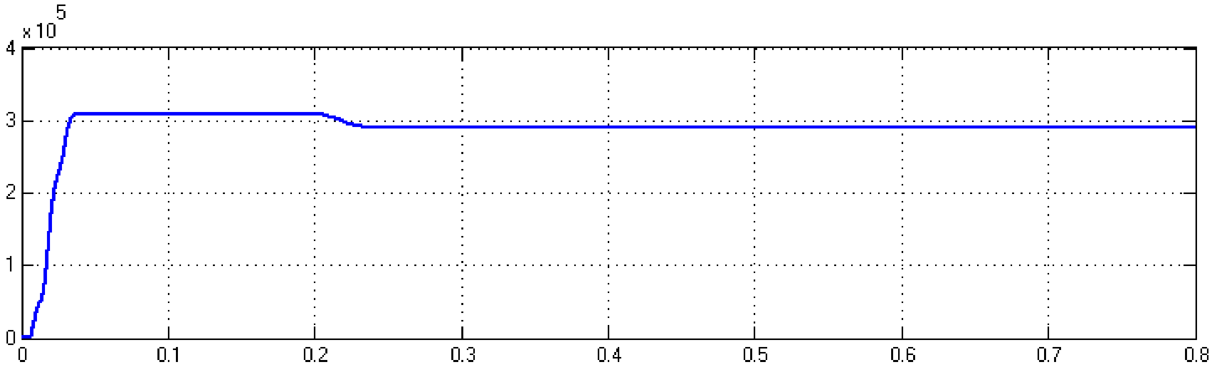

Fig 3.3 Simulation Real Power Of Nine Bus System At Bus-5

The simulation of real of nine bus system at bus-5 are shown in fig 3.3 respectively the real power drops at the time interval of 0.2s when a voltage drops occurs in the circuit.

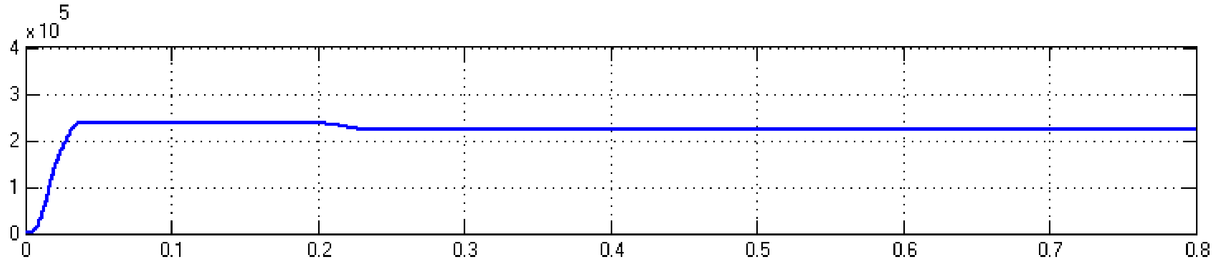

Fig 3.4 Simulation Reactive Power Of Nine Bus System At Bus-5

The simulation of reactive power of nine bus system at bus-5 are shown in fig 3.4 respectively the reactive power drops at the time interval of 0.2s when a voltage drops occurs in the circuit and it cannot attain its steady state condition.

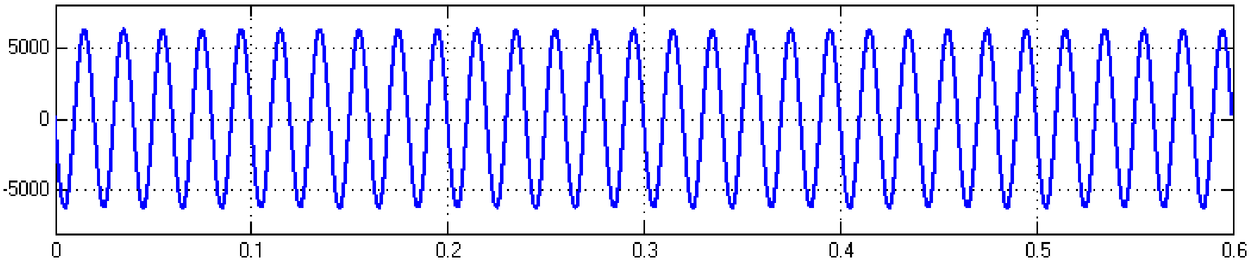

Fig 3.5 Simulation Output Voltage Of Nine Bus System At Bus-6

The simulation of the output voltage of nine bus system at bus -6 is shown in fig 3.5 ,wherethe voltage is in the peak of 5500KV.There is a minute variation of voltage at the time interval 0.2s.

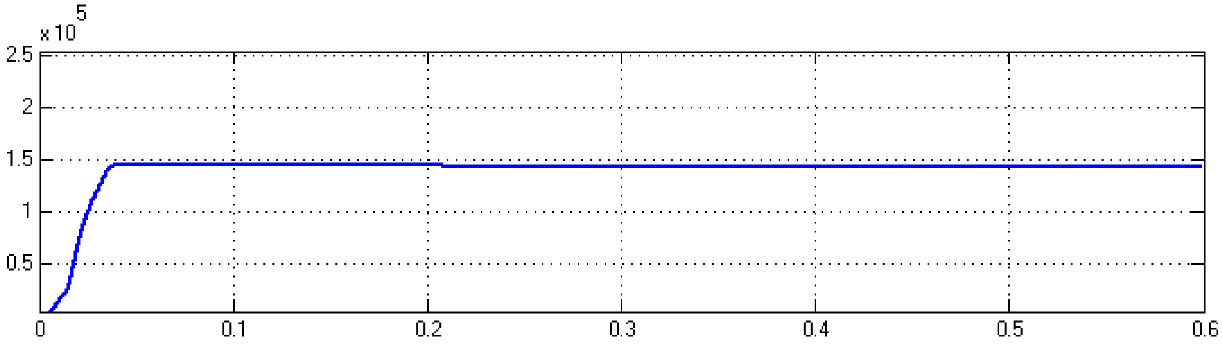

Fig 3.6 Simulation Real Power Of Nine Bus System At Bus-6

The simulation of real powerof nine bus system at bus-6 are shown in fig 3.6 respectively the real power drops at the time interval of 0.2s.

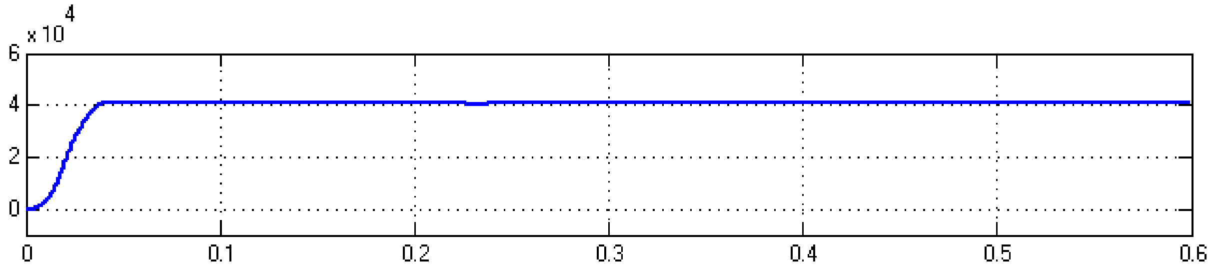

Fig 3.7 Simulation Of Reactive Power Of Nine Bus System At Bus-6

The simulation of reactive power of nine bus system at bus-6 are shown in fig 3.7 respectively the reactive power drops at the time interval of 0.24s when a voltage drops occurs in the circuit .

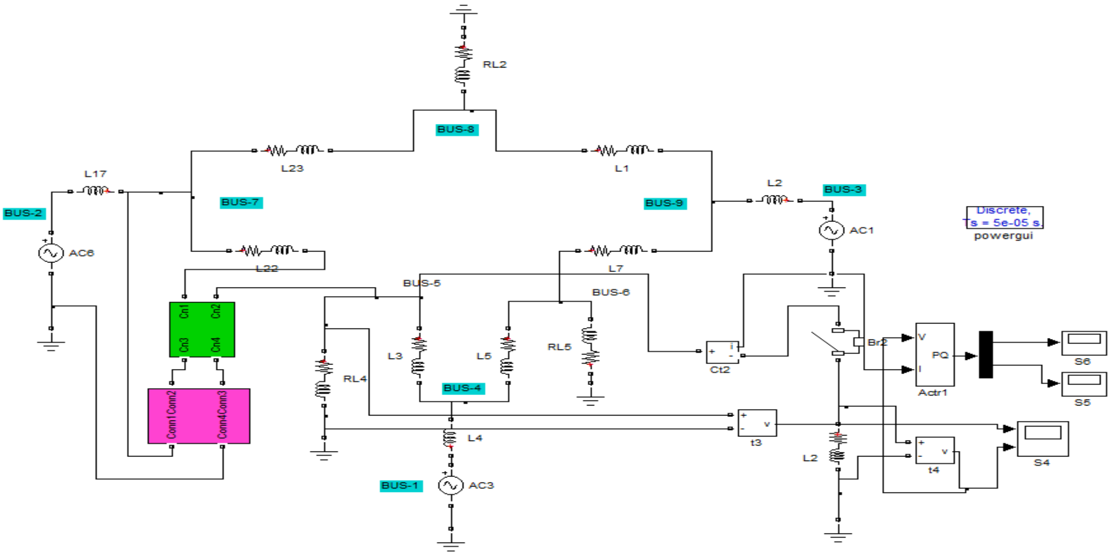

Fig 3.8 Simulink Model Of Nine Bus Model With DPFC

In the fig 3.8 shows the Simulink model of nine bus system with DPFC. The results of the simulation are discussed below. The results are compared with voltage, real power and reactive power.

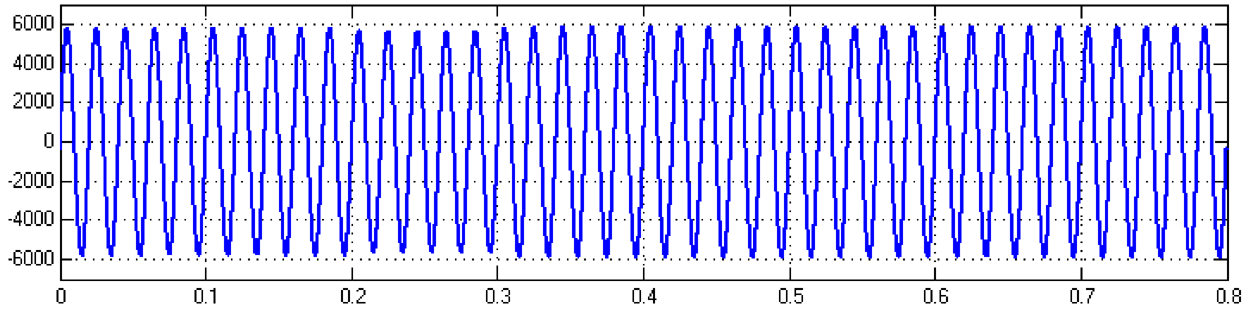

Fig 3.9 Simulation Output Voltage Of Nine Bus System At Bus-5

The simulation of the output voltage of nine bus system at bus -5 is shown in fig 3.9,where the voltage is in the peak of 5000KV.There is a variation of voltage from the time interval 0.2s to 0.3s.

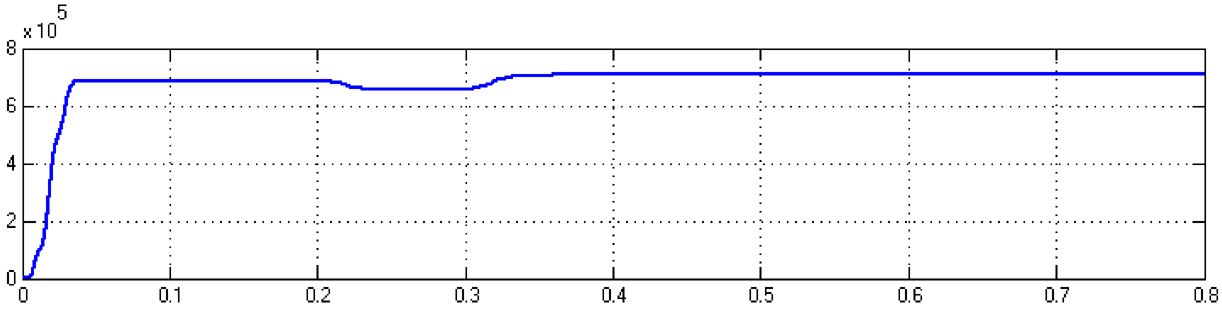

Fig 3.10 Simulation Real Power Of Nine Bus System At Bus-5

The fig 3.10 shows the real power of nine bus system at bus-5 where the real power drops between 0.22 to 0.34. After 0.34 the real power retains it steady state condition.

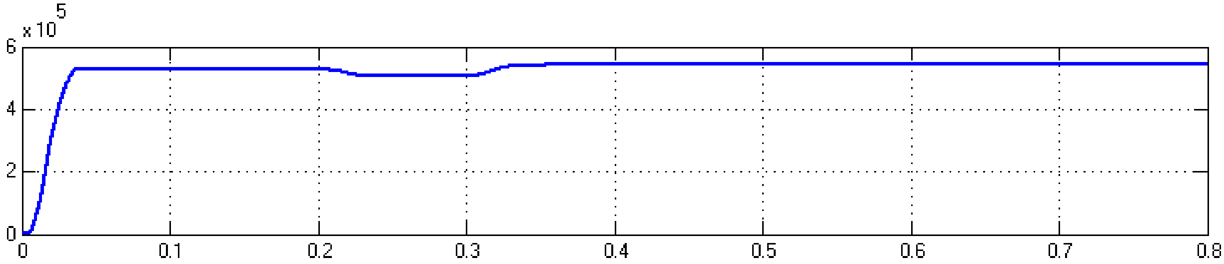

Fig 3.11 Simulation Reactive Power Of Nine Bus System At Bus-5

The fig 3.11 shows the reactive power of nine bus system at bus-5 where the reactive power also drops between 0.22 to 0.34. After 0.34 the real power retains it steady state condition.

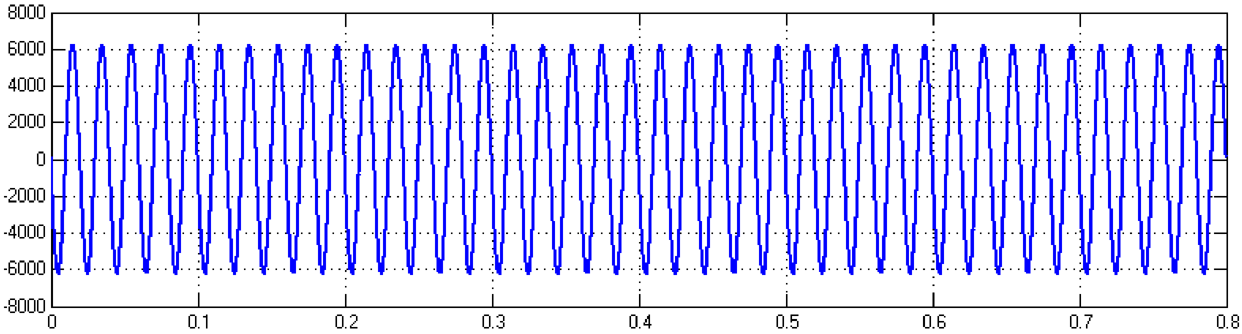

Fig 3.12 Simulation Output Voltage Of Nine Bus System At Bus-6

The simulation of the output voltage of nine bus system at bus -5 is shown in fig 3.12,where the voltage is in the peak of 6000KV.There is a minute variation of voltage from the time interval 0.2s to 0.3s.

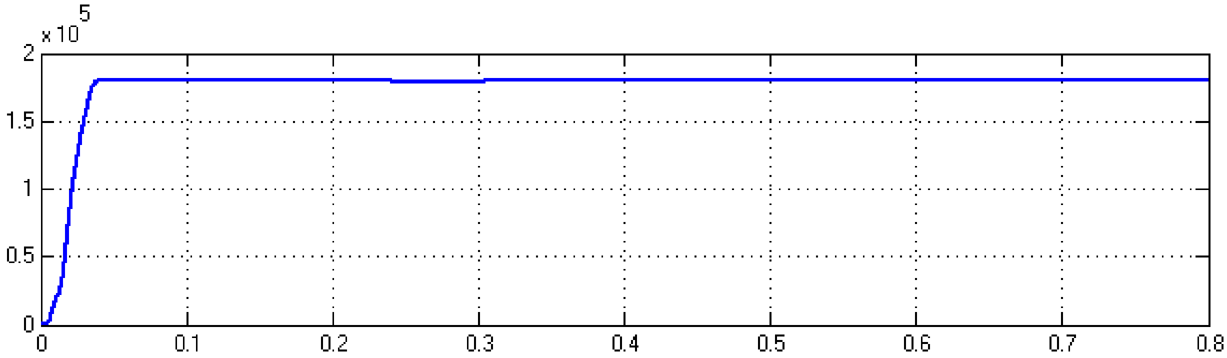

Fig 3.13 Simulation Real Power Of Nine Bus System At Bus-6

The fig 3.13 shows the real power of nine bus system at bus-6 where the real power drops between 0.23 to 0.31. After 0.31 the real power retains it steady state condition.

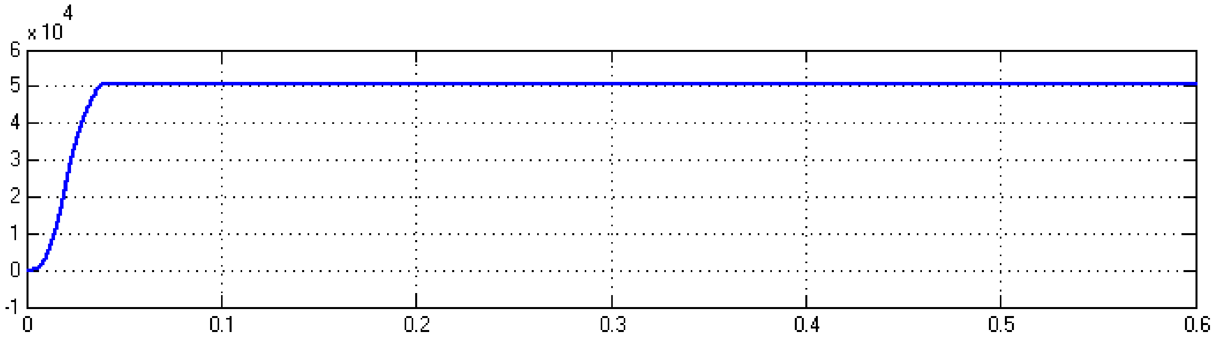

Fig 3.14 Simulation Reactive Power Of Nine Bus System At Bus-6

The fig 3.14 shows the reactive power of nine bus system at bus-6 where there is no change in the reactive power, the steady state condition is continued.

IV.COMPARISION OF REAL POWER & REACTIVE POWER OF NINE BUS SYSTEM

TABLE 1.1

9-bus	Real power (MW) Without DPFC	Real power (MW) With DPFC	Reactive power (MVAR) Without DPFC	Reactive power (MVAR) With DPFC
Bus-5	**0.300**	**0.620**	**0.022**	**0.058**
Bus-6	**0.151**	**0.189**	**0.040**	**0.051**

V. CONCLUSION

The result of utilize distributed power flow controller to compensate unbalanced voltage in nine bus system for open loop system with and without DPFC is compared. The real power increases from 0.800MW to 0.620MW by adding DPFC. The reactive power increases from 0.022MVR to 0.058MVR that the DPFC is capable of maintaining normal real and reactive power during line interruption condition . The disadvantage of proposed system are the requirements of two converters.

The scope of the present is utilize distributed power flow controller to compensate the unbalanced voltages in nine bus system. The line interruption studies in fourteen bus system will be done in future. The studies will be extended multiple line interruption.

REFERENCES

[1] R. C. Dugan and ebraryInc, Electrical power systems quality, 2nd ed. New York: McGraw-Hill, 2003.

[2] M. Chindris, A. Cziker, A. Miron, H. Balan, A. Iacob, and A. Sudria, “Propagation of unbalance in electric power systems,” in Electrical Power Quality and Utilisation, 2007. EPQU 2007. 9th International Conference on, 2007, pp. 1–5.

[3] J. Pedra, L. Sainz, F. Corcoles, and L. Guasch, “Symmetrical and unsymmetrical voltage sag effects on three-phase transformers,” Power Delivery, IEEE Transactions on, vol. 20, no. 2, pp. 1683–1691, 2005.

[4] K. Nohara, A. Ueda, A. Torii, and D. Kae, “Compensating characteristics of a series-shunt active power filter considering unbalanced source voltage and unbalanced load,” in Power Conversion Conference - Nagoya, 2007. PCC ’07, 2007, pp. 1692–1697.

[5] V. Soares, P. Verdelho, and G. D. Marques, “An instantaneous active and reactive current component method for active filters,” Power Electronics, IEEE Transactions on, vol. 15, no. 4, pp. 660–669, 2000.