International Journal of Scientific Research & Engineering Trends
Volume 5, Issue4, July-Aug-2019, ISSN (Online): 2395-566X

Simulation of Real and Reactive Power Flow Assessment with Facts Devices Connected to Transmission Lines

M Tech Scholar Vikash Kumar Yadav
Department of Electrical Engineering
YIT Jaipur
vikash yadav12190gmail.com

Asst. Prof. Neeraj Kumar Kumawat
Department of Electrical Engineering
YIT Jaipur
ankay16@gmail.com

Abstract- **The changeless objective in the field of electrical power networks is to discover better approaches for transmission and distribution of power as far as minimum cost and reliability. Due to explosive growths in the power demand, deregulation and distributed generation facilities, these systems are possible to be exposed to stability problems ever than before. The interline power flow controller (IPFC and UPFC) is one of the most recent age flexible AC transmission system (FACTS) controller used to control power flow of multi transmission lines. The fundamental control for the IPFC is with the end goal that the series converter of the UPFC controls the transmission line real/reactive power flow and the shunt converter of the (IPFC and UPFC) controls the bus voltage/shunt reactive power and the DC connect capacitor voltage. On account of the basic connection, any inverter inside the (IPFC and UPFC) can transfer real power to some other and accordingly encourage real power move among the lines of the transmission system. Since each inverter can give reactive compensation, the (IPFC and UPFC) can do a overall real/reactive power compensation of the whole transmission system. This ability makes it conceivable to even out both real/reactive power stream between the lines, move power from over-burden to under stacked lines, compensate against reactive voltage drops and comparing reactive line power and to expand the viability of the compensating system against system transients. In addition, a simulation model was brought and applied to two transmission line (11KV/6.6KV) and compare their results without UPFC and IPFC, with UPFC and IPFC (Thyristor model) and UPFC and IPFC (IGBT and MOSFET).**

Keywords: Power System modeling, FACTS Controllers, UPFC, IPFC, Power flow, Voltage Source Converter, Matlab Software.

I.INTRODUCTION

FACTS dependent on thyristor activity methods. FACTS controllers are comprehensively series and shunt, both used to change the common electrical attributes of alternating current power network. Series compensation adjusts the transmission or distribution framework parameters, while shunt compensation changes the equal impedance of the load. In both the cases the reactive power that courses through the system can be adequately constrained by FACTS, which improves the general execution of alternating current power system.

1. UNIFIED POWER FLOW CONTROLLER

Unified Power Flow Controller (UPFC), as a delegate of the third era of FACTS device, is by a long shot the most complete FACTS device, in power system steady- state it can actualize power stream guideline, sensibly controlling line real and reactive power, improving the transmission limit of power system, and in power system transient state it can understand quick acting reactive power remuneration, powerfully supporting the voltage at the passage and improving framework voltage security, also, it can improve the damping of the system and power angle stability. The UPFC utilizes solid state devices, which give practical adaptability, for the most part not achievable by regular thyristor controlled frameworks. The UPFC is a blend of a static synchronous compensator (STATCOM) and a static synchronous series compensator (SSSC) coupled through a typical DC voltage connect.

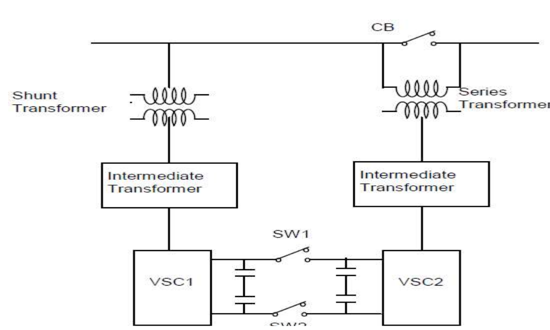


Fig. 1. Schematic of a Unified Power Flow Controller.

2. INTERLINE POWER FLOW CONTROLLER

The interline power flow controller (IPFC) proposed is another idea for the remuneration and functional power flow management of multi-line transmission network. In its general structure, the IPFC utilizes various inverters with a typical DC interface, each to give series compensation to a chose line of the transmission network.

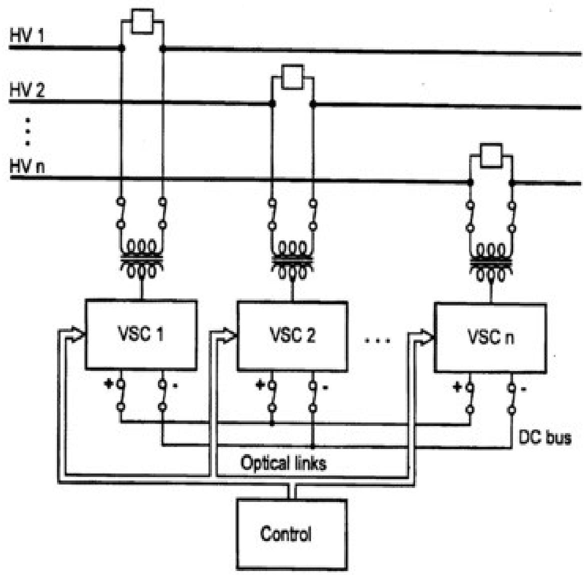


Fig. 2. Schematic of a Interline Power Flow Controller.

II. LITERATURE REVIEW

A. Murugan et al. [1]depicted about another real and reactive power coordination-controller for an interline power flow controller (IPFC& UPFC). The essential control for the IPFC is to such an extent that the series converter of the UPFC controls the transmission line active/reactive power stream and the shunt converter of the IPFC and UPFC controls the bus voltage/shunt reactive power and the DC connect capacitor voltage. On account of the basic connection, any inverter inside the IPFC and UPFC can move real power to some other and consequently encourage active power move among the lines of the transmission network. Since every inverter can give reactive compensation, the IPFC and UPFC can do a general real and reactive power compensation of the all out transmission network. This capacity makes it conceivable to even out both real and reactive power flow between the lines, move control from over-burden to under stacked lines, compensate against reactive voltage drops and comparing reactive line control and to build the viability of the compensating system against dynamic unsettling influences.

Akhilesh et al. [2] have displayed the ongoing idea for the compensation and effective power flowexecutives of multi – line transmission frameworks. In its general structure, the IPFC utilizes various inverters with a typical DC connect, each to give series compensation to a chose line of the transmission network. This paper examines the utilization of IPFC, which are dc/ac converters connected by common DC terminals, in a DG-control framework from an economy point of view. Due to the common connection, any inverter inside the IPFC can move real power to some other and consequently encourage real power move among the lines of the transmission system. Since every inverter can give reactive compensation, the IPFC cancomplete a general real and reactive power compensation of the all out transmission system. This ability makes it conceivable to balance both real and reactive power flow between the lines, move control from over-burden to under stacked lines, compensation againstreactive voltage drops and comparing reactiveline control and to expand the viability of the compensating framework against dynamic unsettling influences.

Deepak,K. Ilango, G.S.Nagamini, C. Swarup, K.S.[3]talked about the exhibition and effect of UPFC on the power system conduct during flaw conditions. A two machine — double line power system with UPFC introduced in one of the lines is considered for the investigation. The thought is to watch the ability of the UPFC to keep up the real and reactive power flow in the compensated line (which incorporates UPFC) and to decrease the tumble off of the bus voltage when there is an grounding fault in the transmission line. Simulink based power framework square set is utilized for numerical recreations. Simulation results show outstanding improvement in the conduct of the whole system with UPFC in maintaining the voltage and power flow even under run of the mill line blames by suitable infusion of series voltage into the transmission line at the point of association. The degree of UPFC ability in keeping up the power streams in the (Line 1), even under deficiency condition in a contiguous parallel (Line 2) is given. Limiting the unsettling influences in voltages, currents and power flow in the issue influenced (Line 2) are likewise talked about.

III. MODELLING OF UPFC AND IPFC

1Simulink Model of 11 kV/6.6 kV Transmission Lines with UPFC (IGBT Base Model)

The Simulink Model is appeared in Fig.4.9 speaks to the two line transmission model which comprises of normal circuit and compensation circuit with an UPFC IGBT-based device. The compensation circuit, Line-I for example 11kV can assimilate PR to the DC interface through the converter or rectifier present in the UPFC system. From the DC connect, in normal period, the non-compensation circuit circuit, Line-2 that is 6.6 kV can give real power from DC interface through converter or inverter.

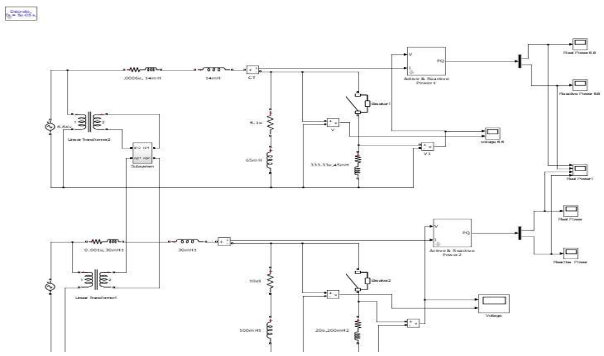


Fig. 3 Simulink Model of 11 kV/6.6 kV Transmission Lines with UPFC.

2 Simulink Model of 11 kV/6.6 kV Transmission Lines with IPFC (DIODE/MOSFET Base Model

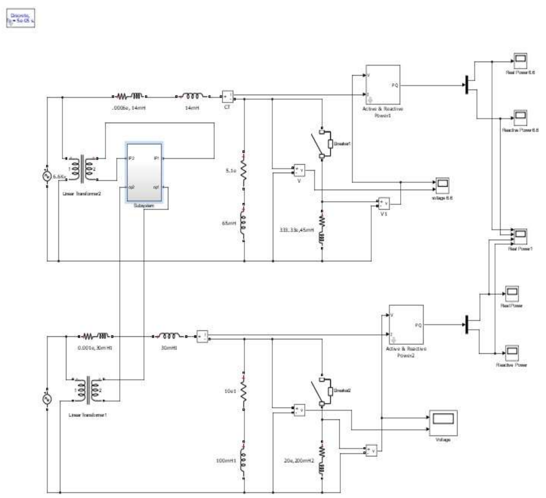
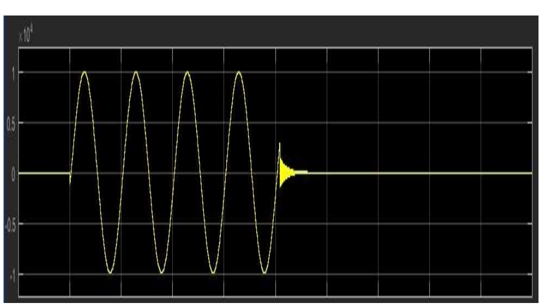


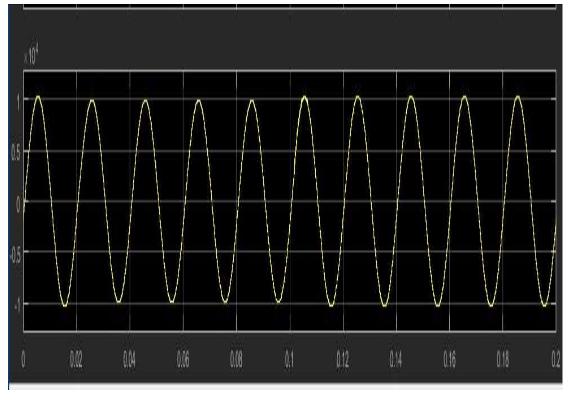
Fig. 4 Simulink Model of 11 kV/6.6 kV Transmission Lines with IPFC.

IV. SIMULATION RESULTS

For result analysis we have taken one steady state time (Tss)=0.04 and analyze real,reactive power and voltage at this point. We have produced waveform of 11 KV and 6.6 KV with UPFC(IGBT model) and IPFC(MOSFET model).



(a) Load 1



(b) Load

Fig. 5. Voltage waveform of 11kV line with UPFC(IGBT Model).

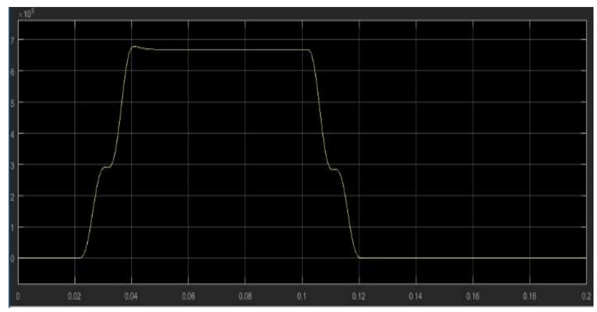


Fig.6. Real Power waveform of 11kV line with UPFC(IGBT) Model.

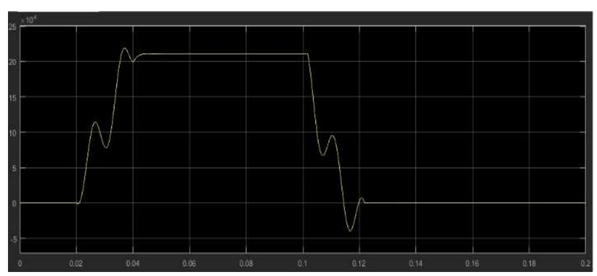


Fig.7. Reactive Power waveform of 11kV line with UPFC(IGBT) Model.

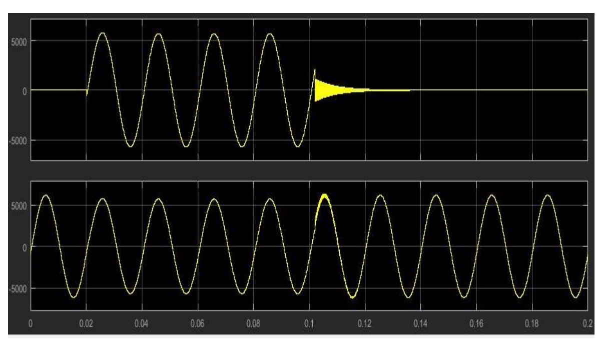


Fig.4.4. Voltage waveform of 6.6 kV line with UPFC(IGBT Model)

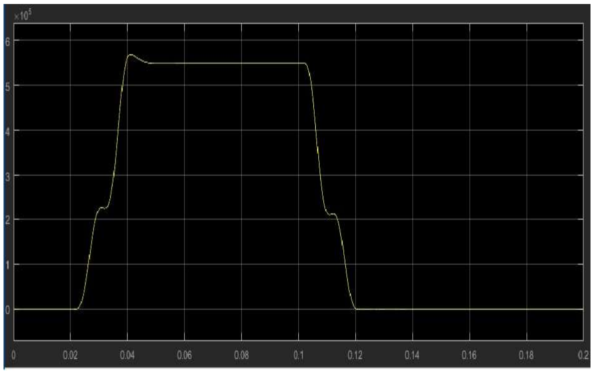


Fig.8. Real Power waveform of 6.6kV line with UPFC(IGBT) Model.

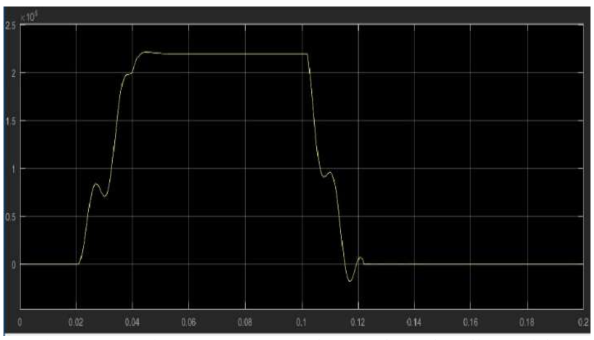
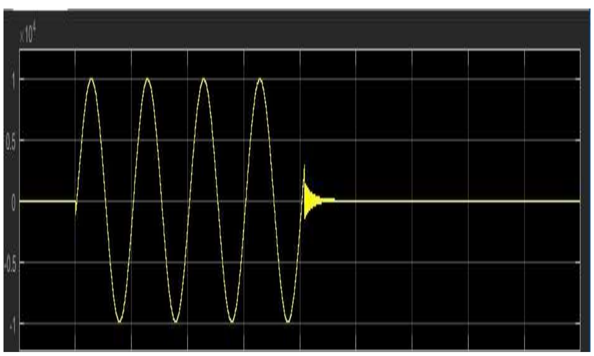
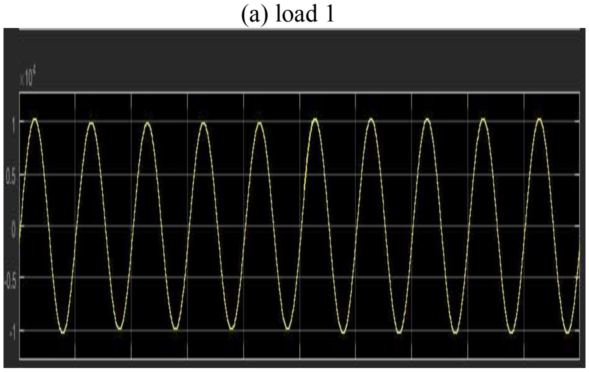


Fig.9. Reactive Power waveform of 6.6 kV line with UPFC(IGBT) Model.



(a) load 1



(b) load 2

Fig..10 Voltage waveform of 11kV line with IPFC(MOSFET Base Model).

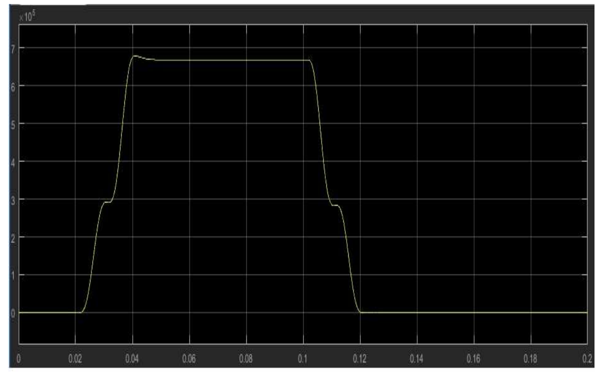


Fig..11 Real Power waveform of 11kV line withIPFC(Diode/MOSFET Base Model).

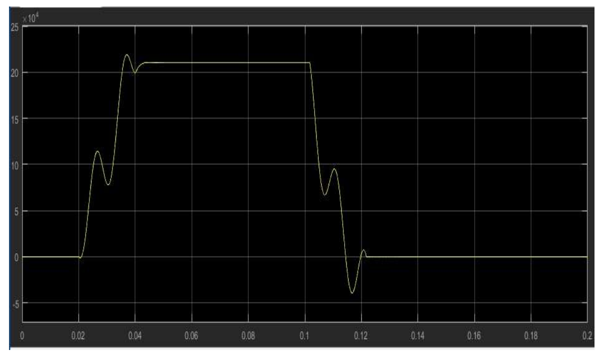


Fig.12 Reactive Power waveform of 11kV line with IPFC(Diode/MOSFET Base Model).

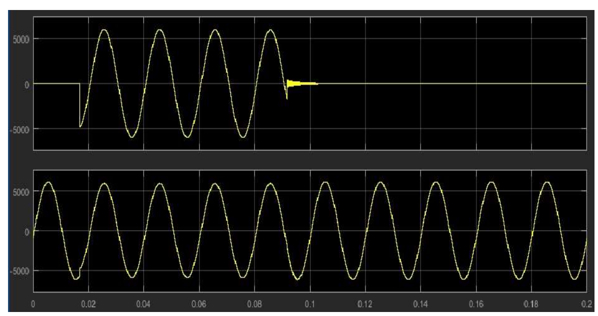


Fig.13 Voltage waveform of load1 and 2 of 6.6 kV line with IPFC (MOSFET Model).

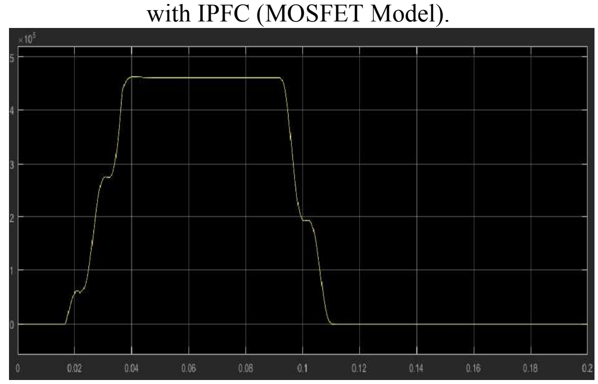


Fig.14 Real Power waveform of 6.6 kV line with IPFC(Diode/MOSFET) Base Model).

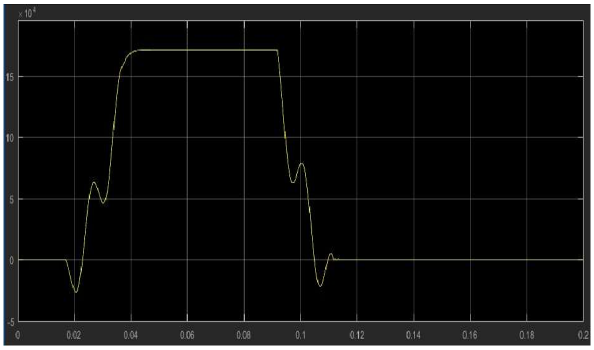


Fig.15 Reactive Power waveform of 6.6 kV line with IPFC(Diode/MOSFET Base Model).

V. CONCLUSION

In this presented work, MATLAB/ SIMULINK model is used to simulate the model of rectifier and inverter based UPFC and IPFC connected with transmission lines of 11kV and 6.6 kV. In this model we use two transmission lines and compare their real power, reactive power and voltage profile through the transmission line. For this result we have taken three cases i.e without UPFC and IPFC with UPFC and IPFC of thyristor and UPFC and IPFC IGBT and MOSFET model. By this it is found that there is an improvement in the real and reactive power as well as voltage magnitude in transmission line.

REFERENCES

[1] A. Murugan, S.Thamizmani, 2013, “A New Approach for Voltage Control of IPFC and UPFC for Power Flow Management”, IEEE 2013.

[2] Yao Shu-jun Song Xiao-yan ; Wang Yan,Yan Yu-xin, Yan Zhi “Research on dynamic characteristics of Unified Power Flow Controller (UPFC)” Published in Electric Utility Deregulation and Restructuring and Power Technologies (DRPT), 2011 4th International Conference.

[3] Bo Hu, KaiguiXie, Karki, R., 2012, “Reliability evaluation of bulk power systems incorporating UPFC”, Published in Probabilistic Methods Applied to Power Systems (PMAPS), 2010 IEEE 11th International Conference.

[4] Shao Zhang Xi Lu , Yang Liu, Baoming Ge, Fang Zheng Peng 2013, Nine IGBTs based UPFC topology and control for renewable power integration” Published in Applied Power Electronics Conference and Exposition (APEC), 2013 Twenty-Eighth Annual IEEE.

[5] Sharma, N.K., Jagtap, P.P., 2010, “Modelling and Application of Unified Power Flow Controller (UPFC)” Published in Emerging Trends in Engineering and Technology (ICETET), 2010 3rd International Conference.

[6] Rafiq, H.,Shakeel, S., Nawaz, S., Bashir, M.K., Saleem, Y., Saleem, M., Izhar, T. 2013, “Control system design of UPFC for optimal power flow control” Published in Open Source Systems and Technologies (ICOSST), 2013 International Conference.