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Improvement of Power Flow in Transmission Line with UPFC Connected To Real and Reactive Power Coordination Controller

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ABSTRACT

UPFC is the most comprehensive multivariable flexible ac transmission system (FACTS) controller. Simultaneously controlling the multiple power system variables with UPFC causes so many difficulties. Also the difficulty of the UPFC control rises because the controlled and control variables interact with each other.

In this paper a new real and reactive power coordination controller is connected to unified power flow controller (UPFC). The actual controls for the UPFC is such that the series converter of the UPFC controls the real/reactive power flow of the transmission line and the shunt converter of the UPFC controls the UPFC bus voltage/shunt reactive power and the voltage of the DC link capacitor. In steady state, series converter's real power demand is supplied by the shunt converter of the UPFC. During transient conditions to avoid the loss of DC link capacitor voltage, a new real power coordination controller has been designed.

Reactive power coordination controller for UPFC is required because that excessive voltage excursions on the UPFC bus take place during reactive power transmission. So a new reactive power coordination controller has been designed to limit excessive voltage excursions during reactive power transfers. MATLAB SIMULINK simulation results have been presented to view the improved performance of the UPFC control with the proposed real power and reactive power coordination controller.

INTRODUCTION

The Ability to control power flow in an electric power system without generation rescheduling or topology changes can improve the power system performance using controllable components, the line flows will be modified in such the way that thermal limits don't seem to be exceed, losses area unit decreased, stability margins area unit hyperbolic and written agreement needs area unit consummated without violating the economic generation dispatch. adaptable AC Transmission frameworks (FACTS) innovation is that the last apparatus for getting the preeminent out of existing instrumentation by means of snappier administration activity and new capacities. the chief putting highlight is that the capacity to straightforwardly administration line streams by basically perpetually changing parameters of the lattice and to execute high-increase kind controllers bolstered snappy movement. the apparatus of FACTS gadgets to power matrix security has been an exquisite in advancement space of investigation. In a large portion of the supposed studies, consideration has been focused on the adaptability of those gadgets to help the capacity framework security by damping framework motions and ostensible tries are made to examine the effect of those gadgets on force matrix constancy. The open doors emerge through the adaptability of FACTS controllers to manage the reticulate parameters that represents the operation of transmission frameworks together with arrangement electric resistance and shunt electric resistance, current, point and damping of motions at differed frequencies underneath the appraised recurrence. These requirements can't be overcome generally, though keeping up the craved framework solidness, by mechanical implies that without bringing down the useable transmission capacity. By giving supplemental adaptability, FACTS controller will change a line to hold control closer to its warm appraising. Mechanical movement must be supplemented by quick reaction power material science. The truths innovation will really be utilized to beat any to as far as possible, inside which case the last word points of confinement would be warm and separator.

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Static volt-ampere management control only one of 3 vital parameters (voltage, impedance, area edge) choosing the capacity stream inside of the AC power framework viz. the adequacy of voltage at first class terminals of line . it's long been finished that Associate in Nursing all strong state or propelled, static volt-ampere compensator, that is genuine likeness perfect synchronous condenser, is in fact conceivable with the usage of Gate Turn-Off (GTO) Thyristor. The UPFC is as of late presented FACTS controller that has the inclination to direct all the four transmission parameters.

The UPFC not solely performs the functions of STATCOM, TCSC, and therefore the point regulator however also provides extra flexibility by combining a number of the functions of those controllers.

AIM OF THE PAPER

The Unified Power Flow Controller (UPFC) comprises of two voltage sourced converters utilizing force changes, which work from a typical DC circuit of a DC –storage capacitor. This game plan capacities as a perfect alternating current to alternating current converter in which the genuine force can openly stream in either heading between the alternating current terminals of the two converters and every converter can autonomously create or retain receptive force at its own alternating current yield terminals.

1) Steady state objective (i.e. genuine and receptive force streams) ought to be

Promptly chronicled by setting the reference of the controller.

2) Dynamic and transient strength change by fitting adjustment of controller reference.

To improve the outline strategy we complete the configuration of the arrangement and shunt branches independently .for every situation, the outer framework is spoken to by straightforward comparable .the outline must be approved when the different sub-frameworks are incorporate

The design tasks are

1. Series injected voltage control

a) Power flow control by series voltage injection

b) UPFC part2 voltage control by series voltage injection

2. Shunt converter voltage control

a) Closed loop current (real and reactive) control.

b) UPFC part1 voltage control by reactive current injection

c) Capacitor voltage regulation using real current injection

The basic design considerations are illustrated using simplified systems models. The performance of all controllers is subsequently evaluated detailed simulation for a case study

MODELING OF UPFC

The control system described in the previous chapter was derived by assuming that the series and parallel converters are treated as ideal controllable voltage sources, that the values of the fundamental components of the line currents are locally available.

The UPFC is modeled by combining the shunt and series branches coupled by the DC voltage control branch. Local load is added to port 1 of UPFC.

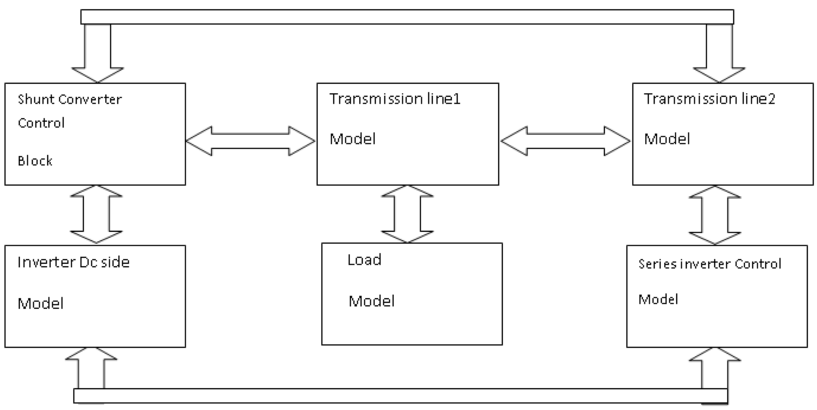
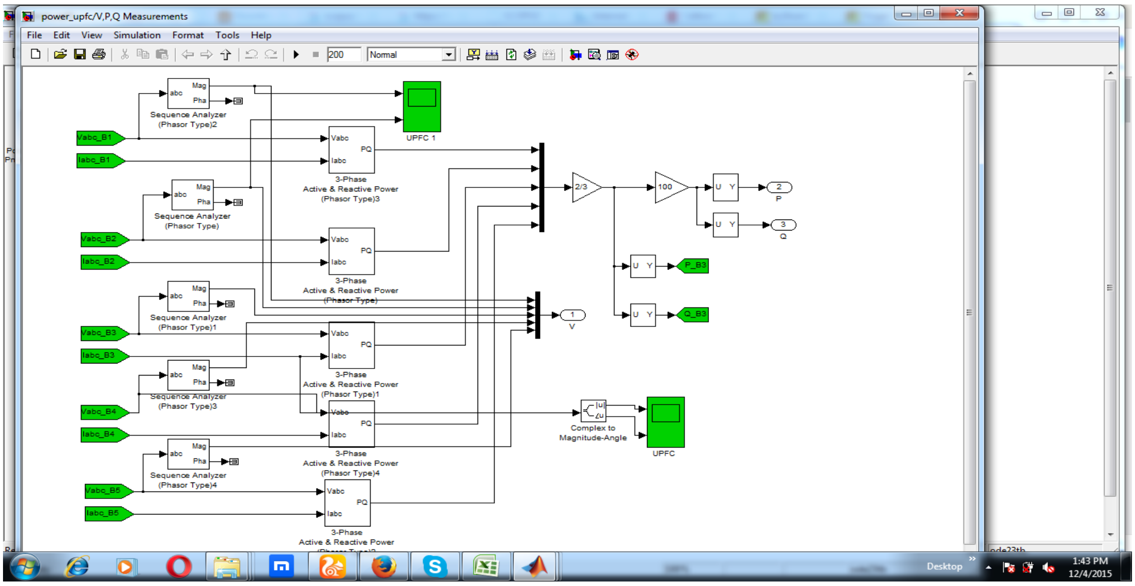
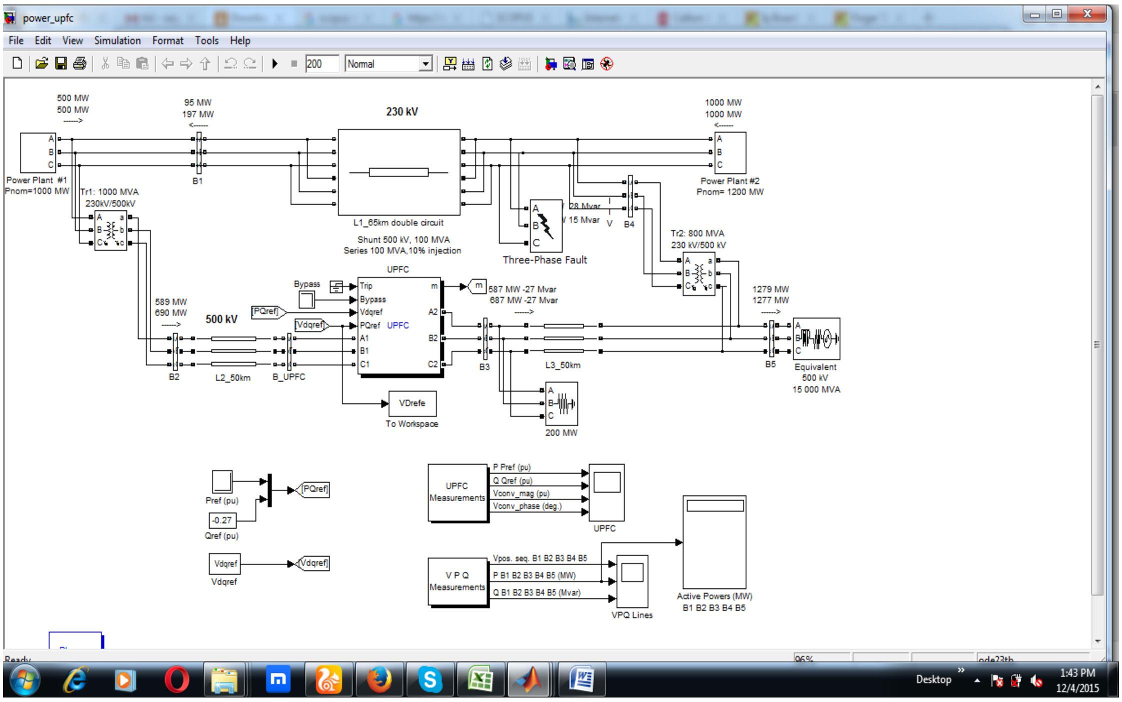
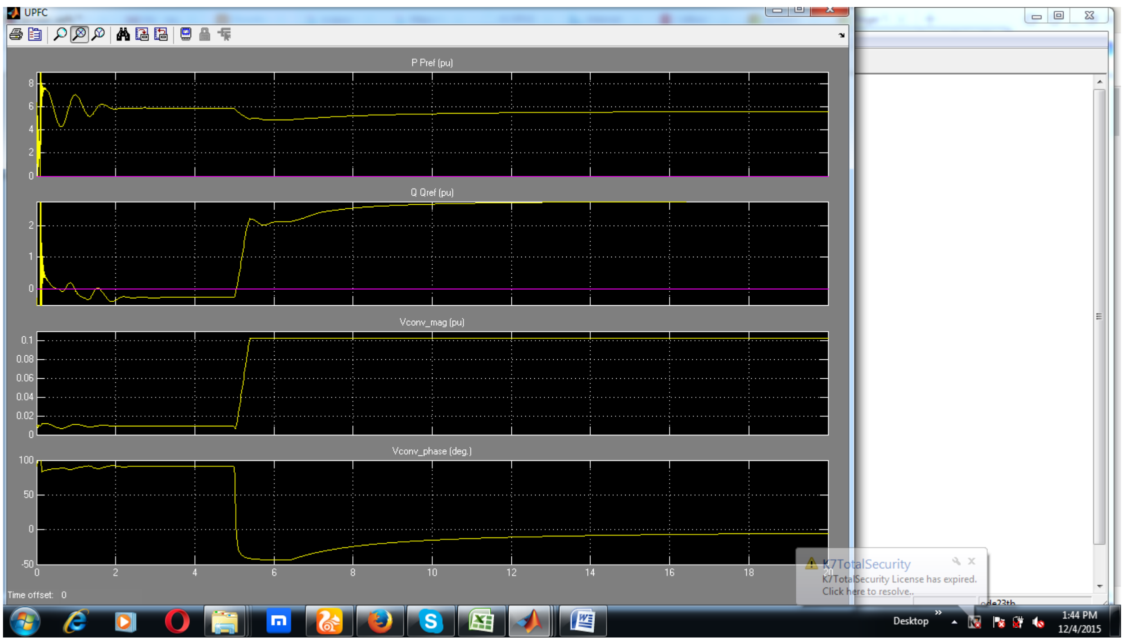
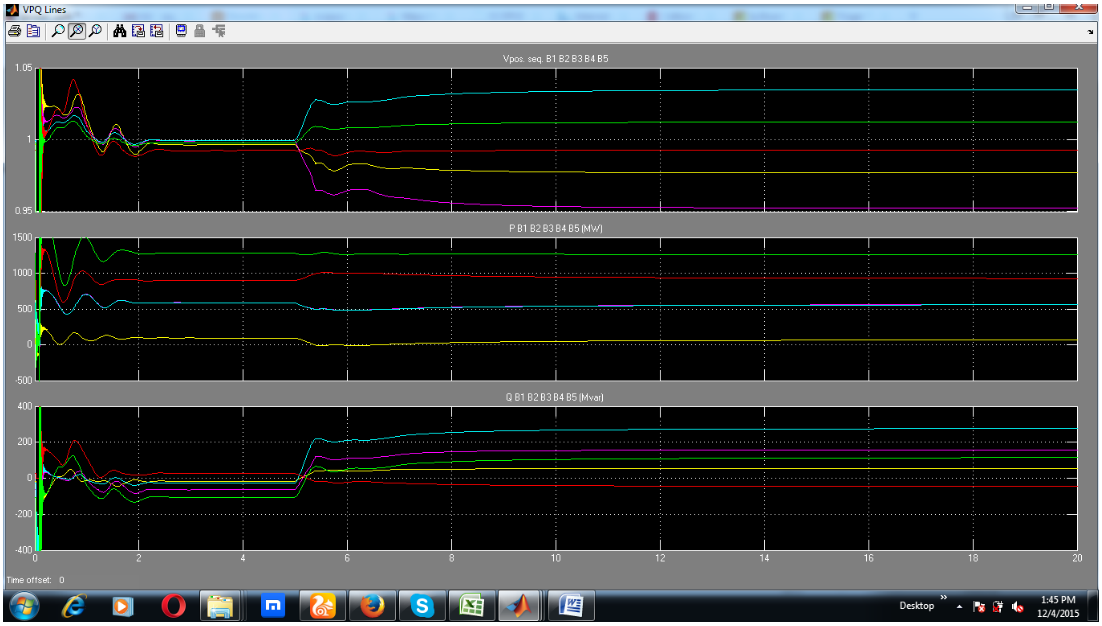


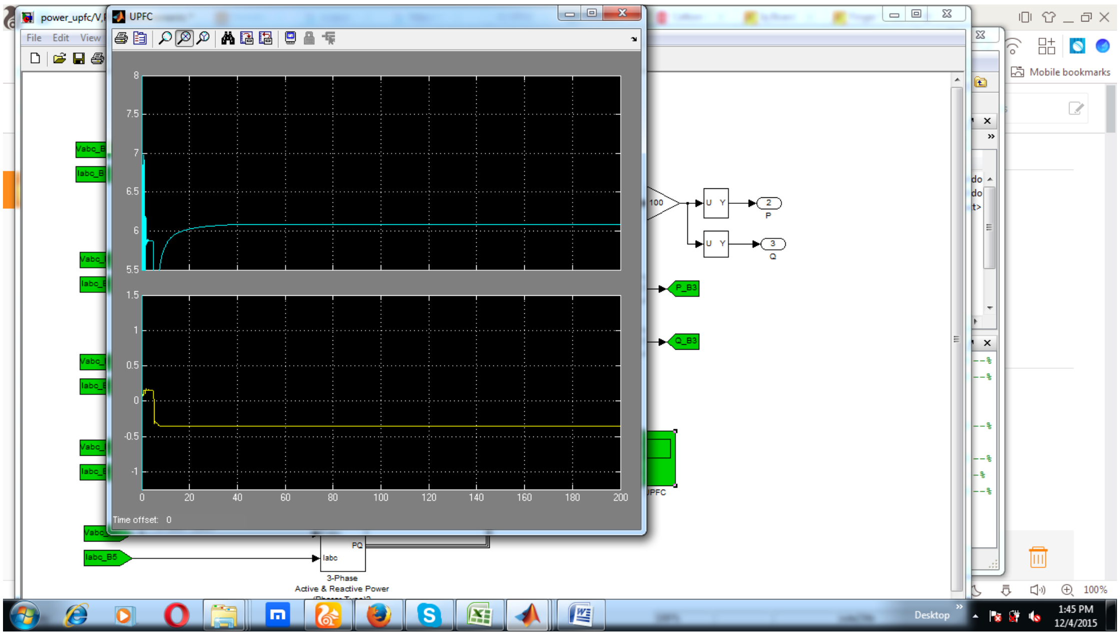
Fig1. *UPFC modeling blocks*

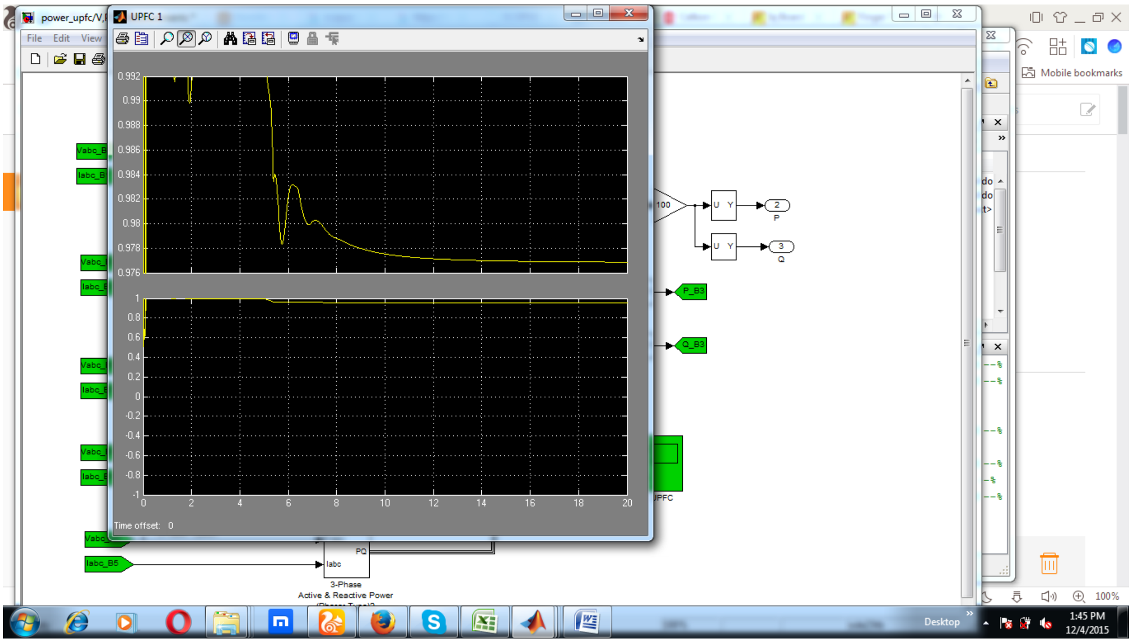

power_upfc/V,P,Q Measurements
File Edit View Simulation Format Tools Help
Sequence Analyzer (Phasor Type)2
UPFC 1
Vabc_B1
Iabc_B1
3-Phase Active & Reactive Power (Phasor Type)3
Sequence Analyzer (Phasor Type)
Vabc_B2
Iabc_B2
3-Phase Active & Reactive Power (Phasor Type)
Sequence Analyzer (Phasor Type)1
Vabc_B3
Iabc_B3
3-Phase Active & Reactive Power (Phasor Type)1
Sequence Analyzer (Phasor Type)3
Vabc_B4
Iabc_B4
3-Phase Active & Reactive Power (Phasor Type)4
Sequence Analyzer (Phasor Type)4
Vabc_B5
Iabc_B5
Complex to Magnitude-Angle
UPFC
P
Q
V
P_B3
Q_B3


power_upfc
File Edit View Simulation Format Tools Help
500 MW
500 MW
Power Plant #1
Pnom=1000 MW
95 MW
197 MW
B1
230 kV
L1_65km double circuit
Shunt 500 kV, 100 MVA
Series 100 MVA,10% injection
1000 MW
1000 MW
Power Plant #2
Pnom= 1200 MW
Tr1: 1000 MVA 230kV/500kV
Three-Phase Fault
B4
Tr2: 800 MVA 230 kV/500 kV
UPFC
Bypass
589 MW
690 MW
500 kV
B2
L2_50km
B_UPFC
587 MW -27 Mvar
687 MW -27 Mvar
B3
L3_50km
1279 MW
1277 MW
B5
Equivalent 500 kV 15 000 MVA
200 MW
VDrefe
To Workspace
Pref (pu)
-0.27
Qref (pu)
Vdqref
UPFC Measurements
P Pref (pu)
Q Qref (pu)
Vconv_mag (pu)
Vconv_phase (deg.)
UPFC
V P Q Measurements
Vpos. seq. B1 B2 B3 B4 B5
P B1 B2 B3 B4 B5 (MW)
Q B1 B2 B3 B4 B5 (Mvar)
VPQ Lines
Active Powers (MW) B1 B2 B3 B4 B5


UPFC
P Pref (pu)
Q Qref (pu)
Vconv_mag (pu)
Vconv_phase (deg.)
Time offset: 0


VPQ Lines
Vpos. seq. B1 B2 B3 B4 B5
P B1 B2 B3 B4 B5 (MW)
Q B1 B2 B3 B4 B5 (Mvar)
Time offset: 0


UPFC
Time offset: 0
3-Phase
Active & Reactive Power


UPFC 1
Time offset: 0
3-Phase
Active & Reactive Power

CONCLUSION

- In this thesis, a control strategy is proposed and tested for the UPFC, which is verified for 3 different cases.
- In all the cases, performance of the system is analyzed through MATLAB/SIMULINK 7.0.1
- Control system driving functions were tuned to attain satisfactory comparison of performance.
- A MATLAB/ Simulink model is simulated in this work for design and validation of control strategy of UPFC, and which is located at a load substation while considering the parameters in to account. Control algorithm is implemented in space vector domain (d-q Co-ordinates).
- The developed SIMULINK model is used to arrive at satisfactory control levels and attains enough gain settings in various parts of the UPFC controller.
- Detailed simulation of UPFC system with bus voltage, UPFC second part voltage and line power flow control was carried out using the developed SIMULINK model various cases involving load switching, step change in voltage reference and power flow references.
- SUB cycle rises and fall times are achievable for voltage control and power control using the developed UPFC control strategy. This was verified by detailed simulation.

For step change in burden, rise and fall times saw in port 1 voltages are Tr=0.025sec, Tf=0.02 sec; chance in port 1 voltage (1-0.975-1).

For step change in burden, rise and fall times saw in port 1 voltages are Tr=0.0005 sec, Tf=0.001 sec; chance in port 1 voltage (3-3.6-2.88-3).

For step change in sending end voltage (1-1.05) the ascent and fall times saw in port 1 voltages are Tr=0.015sec, Tf=0.003 sec ;chance in port 1 voltage(1-1.06-1).

Here Real power stream control is procured by responsive voltage imbuement and deviant power stream control is gotten by control of voltage at the two ports of the UPFC.

The controllers are laid out self-rulingly and use locally available estimations.

By tweaking the dynamic compel, it is possible to get an incomprehensible change transient consistent quality and damping.

As seen the UPFC phenomenally improves system damping, truly, it fundamentally neutralizes force faltering. Besides, be seen that also improves in a general sense the damping of the voltage swings.

From the waveforms, we can reason that the UPFC can respond rapidly i.e. of the solicitation of a cycle to a pulse change in power reference and the limit of the UPFC to coordinate both the power and voltages at both ports.

SCOPE FOR FUTURE RESEARCH WORK

The made model can be used for thinking about the effect of voltage unbalance, voltage music and weight current sounds on the execution of UPFC control.

These assorted perspectives give scope for future examination take a shot at those grounds.

The reducing of music and estimations of its power with respect to assorted numerical examination i.e., (hard and fast symphonious mutilation) could be worked out.

Injection of channels at diverse levels is to be vanquished wiping out/div

REFERENCES

[1] L. Gyugyi, C. D. Schauder, S. L. Williams, T. R. Reitman, D. R. Torgerson, and A. Edris, "The unified power flow controller: A newapproach to power transmission control," *IEEE Trans. Power Delivery*, vol. 10, pp. 1085–1097, Apr. 1995.

[2] C. D. Schauder, L. Gyugyi, M. R. Lund, D. M. Hamai, T. R. Rietman, D. R. Torgerson, and A. Edris, "Operation of the unified power flow controller (UPFC) under practical constraints," *IEEE Trans. Power Delivery*, vol. 13, pp. 630–636, Apr. 1998.

[3] K. K. Sen and E. J. Stacey, "UPFC-UnifiedPower flow controller: Theory, modeling, and applications," *IEEE Trans. Power Delivery*, vol. 13, pp. 1453–1460, Oct. 1999.

[4] B. A. Renz, A. S. Mehraben, C. Schauder, E. Stacey, L. Kovalsky, L. Gyugyi, and A. Edris, "AEP unified power flow controller performance," *IEEE Trans. Power Delivery*, vol. 14, pp. 1374–1381, Oct. 1999.

[5] P. K. Dash, S. Mishra, and G. Panda, "A radial basis function neural netwrok controller for UPFC," *IEEE Trans. Power Syst.*, vol. 15, pp. 1293–1299, Nov. 2000.

[6] "Damping multimodal power system oscillation using a hybrid fuzzy controller for series connected FACTS devices," *IEEE Trans. Power Syst*, vol. 15, pp. 1360–1366, Nov. 2000.

[7] Z. Huang, Y. Ni, F. F. Wu, S. Chen, and B. Zhang, "Appication of unified power flow controller in interconnected power systems-modeling, interface, control strategy and case study," *IEEE Trans. Power Syst*, vol. 15, pp. 817–824, May 2000.

[8] Y. Morioka, Y. Mishima, and Y. Nakachi, "Implementation of unified power flow controller and verification of transmission capability improvement," *IEEE Trans. Power Syst*, vol. 14, pp. 575–581, May 1999.

[9] P. C. Stefanov and A. M. Stankovic, "Modeling of UPFC operation under unbalanced conditions with dynamic phasors," *IEEE Trans. Power Syst.*, vol. 17, pp. 395–1403, May 2002.

[10] H. F.Wang, "Aunified model for the analysis of facts devices in damping power system oscillations part I: Single machine infinite-bus power systems," *IEEE Trans. Power Delivery*, vol. 12, pp. 941–946, Apr. 1997.