Intelligent Controllers for shunt and series converters of Unified power flow controller

ABSTRACT

In today's world to use the current transmission line to its full limit Flexible AC Transmission framework (FACTS) are employed. The power stream control is successful if every one of the components of the transmission line must be fluctuated all the while or exclusively. To accomplish this, the most important fitting FACTS gadget is Unified Power Flow controller (UPFC). The utilization of ordinary controllers postpones the basic leadership procedure to make reasonable control move amid dynamic conditions. In this paper a fuzzy rationale based controller is utilized to produce imperative damping signals and to control the shunt converter of upfc. Two different neuro-controllers are utilized for arrangement converter control. Subsequently coordination among shunt and arrangement converters of UPFC is accomplished. The simulation in MATLAB condition will clarify the execution of UPFC..

Keywords— Co-ordination; FACTS; Fuzzy logic; Neural network; UPFC

INTRODUCTION

The revolution in power electronic based intelligent controllers upgraded the stability and controllabiltiy of intensity frameworks. Realities are the a standout amongst the best answers for tackle the issue in the impediments of developing extra transmission lines in order to fulfill the expanded need of electric power. The fore-most goal of FACTS is to show signals of improvement the power exchange, warm and limit capability of present transmission lines close to as far as possible and to adequately control the power streams in the chose passages. The directing methodology must deal with dynamic varieties of transmission line parameters explicitly transport voltage, line impedance and stage plot for prevalent transmission framework the executives through improved transient power framework consistency.

Many important gadgets improve the consistent quality of the power framework together by methods for its dynamic guideline properties and standard make up potential. The contrasting point of FACTS innovation is oversea control stream and to extend the transmitting limit over a functioning transmission condition. Actualities similar to structures with power electronic compensators like the Static Compensator (STATCOM), Static Synchronous Series Capacitor (SSSC), Thyristor Controlled Series Capacitor (TCSC) . There are two particularly unique ways to deal with the controllers of FACTS gadgets which mean to address focused on transmission framework pay and control issue. In Static VAr Compensator (SVC) and Thyristor Controlled Series Capacitor (TCSC),the ability to generate reactive power

and exchange of power are seperable. On the off chance that these are utilized for responsive power alteration they are inept to swap over genuine power with air conditioning framework. To trade genuine power, if SVC and TCSC are used, these are unfit to supply receptive capacity to the framework. If there should be an occurrence of STATCOM, SSSC controllers have characteristic capacity of taking care of trade of both genuine and receptive forces with air conditioning framework without air conditioning condensers or substantial inductors. Here the genuine and responsive power directing techniques are dependent.

Be that as it may, amid dynamic aggravations, for example, hamper, some of the time there ought to be a controller to deal with inalienable trade of genuine and receptive powers freely. Accordingly the objective is to devise a controller with isolating dynamic and responsive forces for the term of the procedure of dynamic blame condition. UPFC is such a controller which can autonomously or all the while control the trading of real and active power.

I. UPFC

A **unified power flow controller** electrical device for providing fast-acting reactive power compensation on high-voltageelectricity transmission networks. It uses a pair of three-phase controllable bridges to produce current that is injected into a transmission line using a series transformer. The controller can control active and reactive power flows in a transmission line.. UPFC comprises of the considerable number of highlights of STATCOM, SSSC and stage shifter. It can independently or momentarily control the transmission line impedance, stage edge and voltage. The basic hypothesis of UPFC is that, the stage point influences stream of genuine power and the extent of voltage influences stream of receptive power. Accordingly in transmission lines, to deal with the genuine power stream the arrangement controller of UPFC alters the arrangement infused voltage edge, in the meantime as the measure of arrangement infused voltage manages the responsive power stream. In this way the genuine power controller can obviously affect the dimension of responsive power stream. The receptive power controller changes the estimation of arrangement voltage added to the framework which further adjusts genuine power stream. In this way these two controllers are reacting to other's belongings.For achieving the system’s

stability, self-governing control systems are realized with conventional controllers that posses sluggish reaction times.

An interconnected electrical transmission network comprises of innumeral factors. Therefore it is necessary to arrange such framework utilizing customary insightful strategies. As the stacking conditions are changing every now and then the working of intensity framework changes ceaselessly. Such non-straight non-stationary power framework can be adequately constrained by computerized reasoning procedures like fuzzy or intelligent controllers . In the event that the sources of info and yields are reasonably chosen, these controllers can react precisely to the dynamic changes. The collaborations connecting information and yield can be distinguished by the neural systems proficiently. Henceforth fake shrewd controllers are vital in improving force framework execution

II. Simulation Of Upfc

In this model of UPFC is considered for simulation purpose. In the present model the estimation of arrangement infused voltage is divided into two sections in which one portion is used in-stage with the framework transport voltage used to control the reactive power and the other portion with the framework transport voltage used to control the active power through the line.The phasor diagram of series voltage is shown in fig.1.

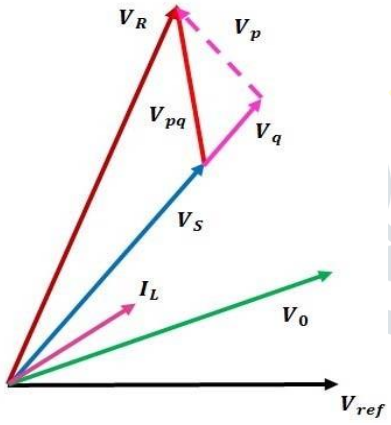


Fig.1. Phasor diagram of series injected voltage.

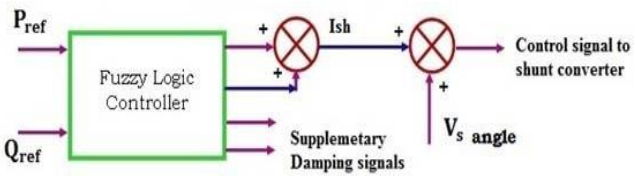


Fig.2: Block diagram of shunt converter control circuit.

To cope with the voltage steady at Point of Common coupling (PCC) and to reproduce powerful damping signals which will be added to active and reactive power references, a fuzzy rational based shunt controller is planned.

The block diagram of fuzzy logic based shunt converter is shown in fig.2.

The genuine and receptive power references are the two contributions to the fluffy controller. This controller gives four yields. Initial two yields are the in-stage and quadratic pieces of shunt flows and the staying two yields are the beneficial damping signals no doubt and receptive contributions of UPFC for brisk damping of rotor motions which are appeared in fig.3.

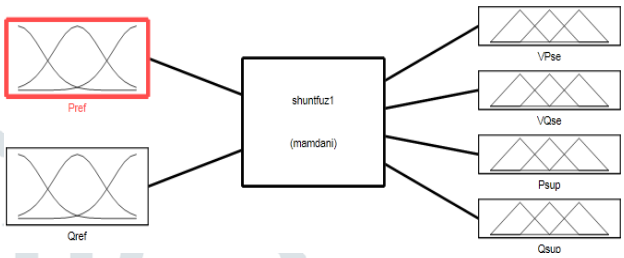
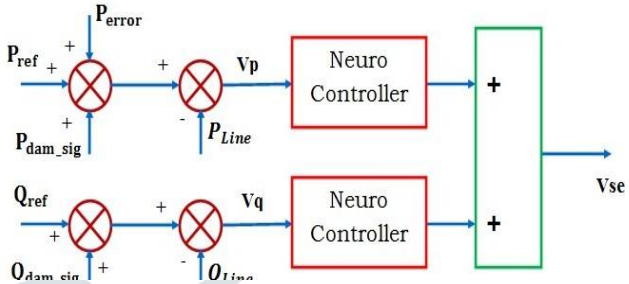


Fig.3: Inputs & outputs of Fuzzy controller.

The triangular wave capacitors are considered for all data sources and yields. For defuzzification, centroid strategy is utilized.



Absolutely 15 rules are used. For arrangement controller two separate fuzzy controllers are utilized for controlling d and q segments of arrangement extra included voltage.

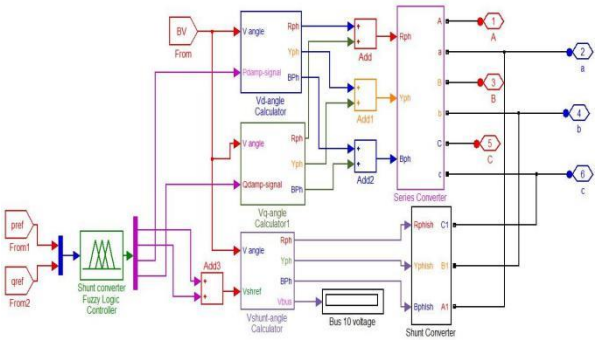


Fig.4: Block diagram of series converter control circuit.

The graph of propsed model of upfc in shown in figure above . The advantageous damping signals produced by shunt converter are associated with acrive and reactive power contributions of arrangement converter.

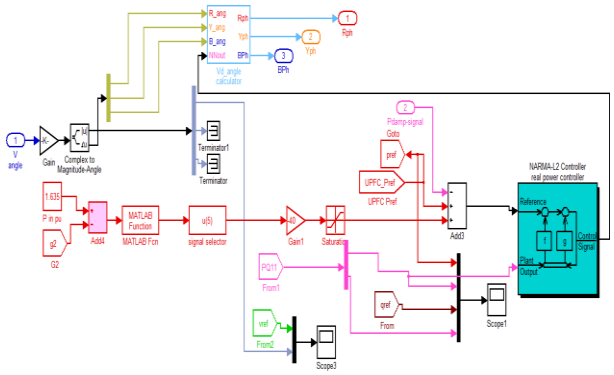


Fig.6. Neuro-controller for q-axis component of injected voltage

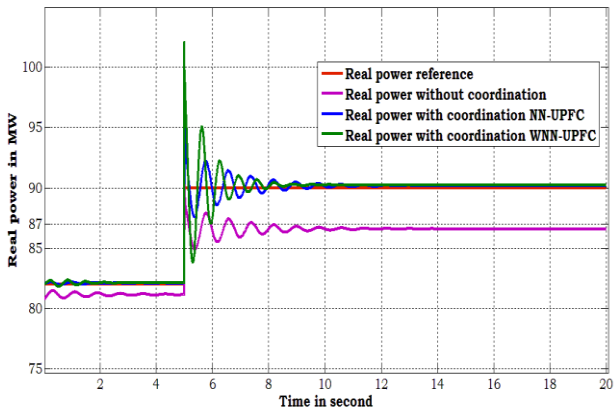


Fig.8. Variation of real power during step increase in real power

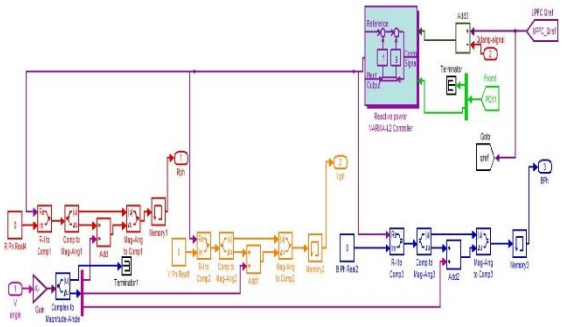


Fig.7. Neuro-controller for d-axis component of injected voltage

The figures 6 and 7 shows the recreation charts of arrangement controller circuit which makes the useof two different neuro controllers. The artificial systems consists of one info neuron six hidden layers and one yield neuron.

III. RESULTS

The simulation is executed to check the operation of proposed UPFC. The operational conduct of the proposed UPFC is tried for minutes changes in active and reactive power

At first glance the genuine power reference is seen at 82MW. At that point genuine power is directed to an unexpected difference of 8MW. The variation in genuine and responsive forces is shown in fig.8 and fig.9. The voltage proportional to this change is shown in fig.10.

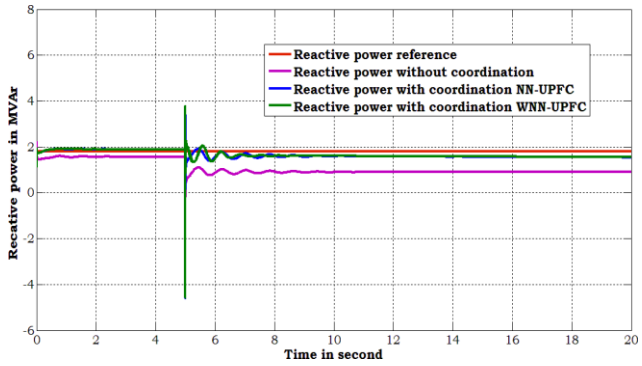


Fig.9. Variation of reactive power during step increase in real power

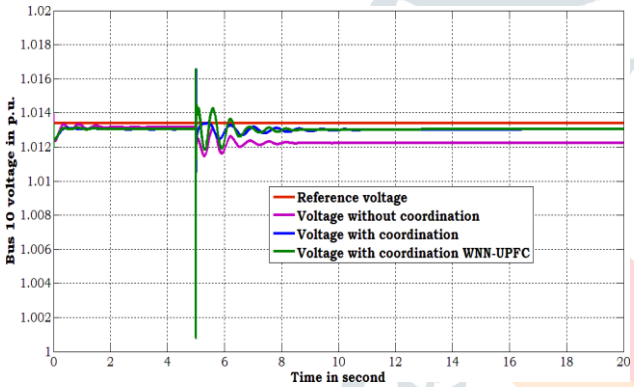


Fig.10. Variation of bus voltage during step increase in real power

From the above waveforms appeared in fig.8 , fig.9 and fig.10,we can confer that without coordination between shunt and series arrangement converters the genuine power can't accomplish its full potential. The reactive power and voltage quantities are hampered from their endorsed qualities. While with coordination the genuine, receptive forces and voltage esteems are close to the endorsed qualities.

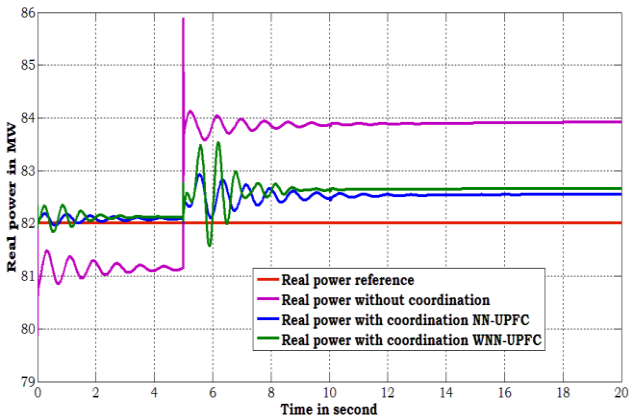


Fig.11. Variation of real power during step increase in reactive power

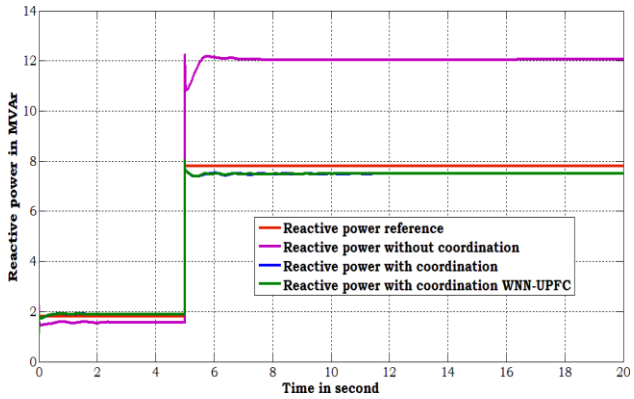
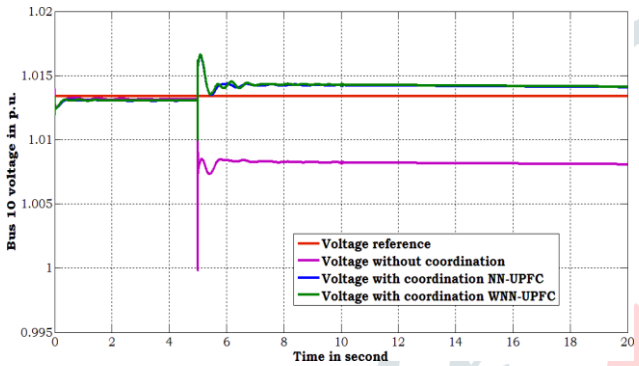


Fig.12. Variation of reactive power during step increase in reactive power



At that point the UPFC is tried for a stage variety in the responsive power. At first the receptive power is at 1.8 MVAr. A stage change of 6MVAr in responsive power is made at 5 second. The variety in genuine and responsive forces is appeared in fig.11 and fig.12. The voltage variety amid this change is portrayed in fig.13.

Fig.13. Variation of bus voltage during step increase in reactive power

From the waveforms above in fig.11, fig.12 and fig.13, it is clear that without coordination among shunt and arrangement converters the receptive power can't achieve its ideal esteem.. With coordination between shunt and series arrangement controllers, the deviation in genuine power is extremely less from its recommended settings. Same way the transport voltage esteem is close to the recommended qualities.

IV. CONCLUSION

In this paper we talked about the coordination of shunt and series arrangement of upfc.The above simulation clears that the coordination among shunt and arrangement controllers improves the stabiltiy and execution of UPFC. The adjustments in genuine and receptive powers in the line will influence the transport voltage if coordination between the controllers is not apt. With the coordination between the controllers the transport voltage will be good and maintained more or less constant even during the fluctuations in line flows. This coordination control among shunt and arrangement converters can likewise be utilized to improve the transient execution of intensity framework amid dynamic conditions

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