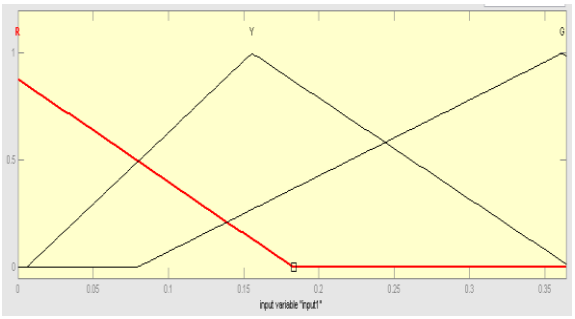


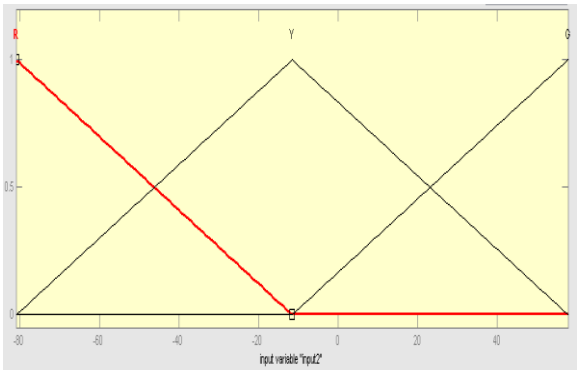


**Figure 6:** input membership function

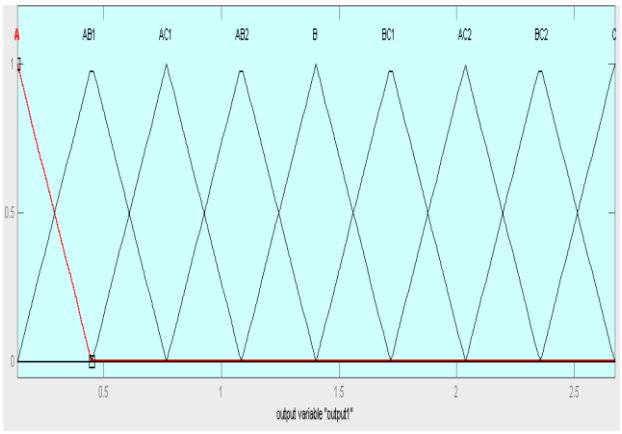


**Figure 7:** Output membership functions

IF-THEN rules are implemented as :
IF ( input 1 =R) and ( input 2 = R )THEN (Iqref = A)
IF ( input 1 = R ) and ( input 2 = Y)THEN (Iqref = AB1)
IF (input 1 = R ) and ( input 2 = G ) THEN ( $I_{qref}$ = AC1)

**Table 1:** Rule chart

| OUTPUT | | INPUT 2 | | |
|---|---|---|---|---|
| | | R | Y | G |
| INPUT 1 | R | A | AB1 | AC1 |
| | Y | AB2 | B | BC1 |
| | | AC2 | BC2 | C |

## 7. Simulation Analysis

CASE I: Considering initial condition

In this case the System behavior is seen when there is no fault in the system. The simulations are carried out and comparison is made between both the controllers. The dotted line shows the result of fuzzy and normal line indicates about PI. Fig shows the terminal voltage of IG. Results clearly indicate that fuzzy gives more stable result than PI. The terminal voltage gets stable faster with fuzzy controller than PI controller as shown in figure. Looking at figure 9, there is a wide difference in the result of both the controllers, even when the fault did not occurred the reactive power generated by STATCOM with fuzzy controller fives better performance than PI .

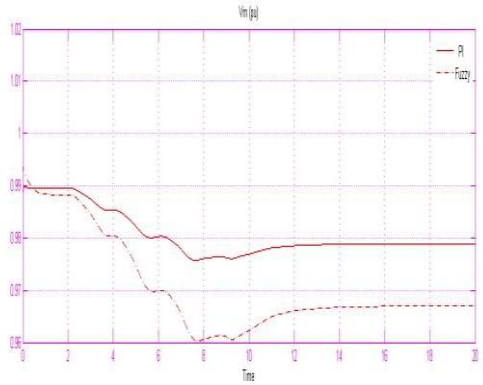


**Figure 8:** Terminal voltage of IG under initial state

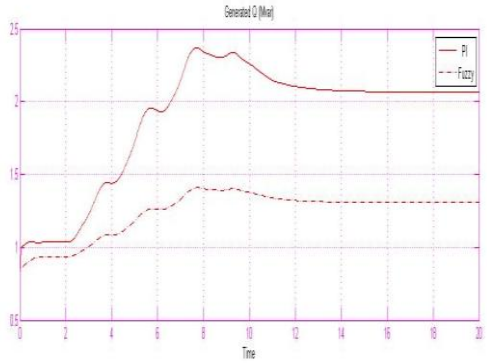


**Figure 9:** Reactive power generated by STATCOM

**CASE II:** When fault occurs in the system

Now considering when LLLG fault occurs into the system. Fault time is set at 15sec, for reactive power compensation STATCOM is connected in the system. When fault occurs into the system, need of reactive power compensation increases. Looking at the voltage profile of figure 10, when fault occurs it gets completely dip at 15 sec with PI controller and recovers after sometime, but with fuzzy controller it recovers almost in 15.1 sec. Similarly reactive power compensation with PI controller takes more time to make the system stable but with fuzzy it immediately improves the transient stability of the system by compensating reactive power and recovers the system making it stable within less time.

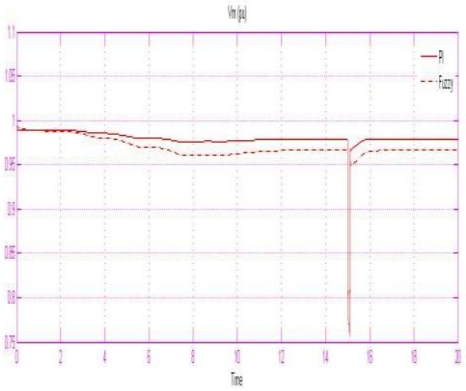

**Figure 10:** Terminal voltage during LLLG fault

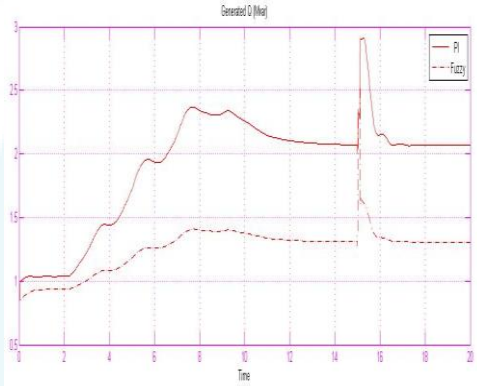

**Figure11:** Reactive power generated during LLLG

CASE III : When fault occurs at the Grid

Another case is considered, when fault occurs at the grid itself. Simulation results is been carried out when the amplitude of the grid is changed i.e when fault occurs into the grid respectively. Results are compared with PI & fuzzy controller connected in STATCOM gives the following results regarding the affect on terminal voltage of STATCOM when amplitude gets changes into the grid. Seeing the results it can be concluded that STATCOM with fuzzy gives much stable performance than PI controller.

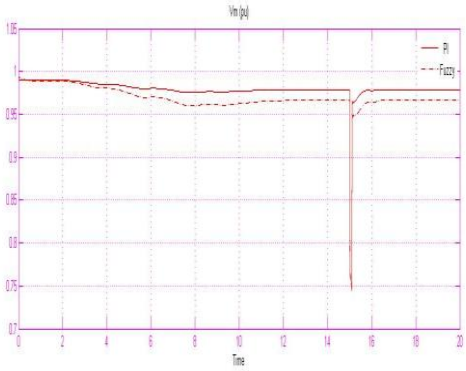

**Figure12:** Behavior of voltage during fault at grid

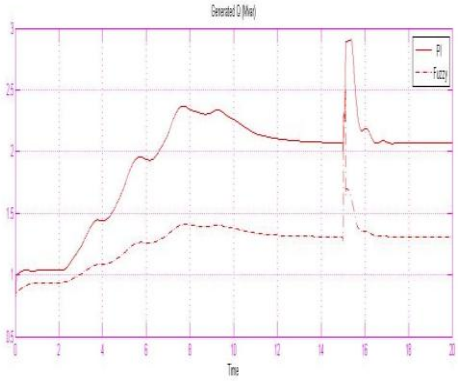

**Figure 13:** Reactive power generated during fault at grid

## 8. Conclusion

In this work, importance of renewable source of energy especially wind energy is focused onto which the importance of FACTS device STATCOM is projected. Here in this work STATCOM based on voltage source converter is been used with two different controllers PI and FUZZY. STATCOM is a FACTS device that not only enhances steady state stability but also improves transient stability of the system when any disturbance or any severe fault occurs into the system. Comparative analysis between PI and FUZZY controllers has been made to detect which controller gives better performance with STATCOM. Simulation is done using MATLAB. Results clearly prove that fuzzy controller based STATCOM gives much better result than PI controller. In our future we would like to study wind turbine based on doubly fed induction generator and its effect on the system

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