Transient Stability Improvement in Multi Machine Ac/Dc Power System Using HVDC Controllers

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***Abstract*- This paper deals with the process of Improve Transient Stability in An interconnected 24 bus power system by using HVDC links modulation control Strategies. The Transient stability improve by using FUZZY logic controller in this paper.AC variables Such as rotor speeds, voltage phases, and tie-line power flows are used as input to the controller that modifies. The power flow setting through the HVDC links. The proposed technique is tested on the 24-bus reliability test system. The paper shows that HVDC modulation can be lead to substantial improvement in transient stability.**

Index terms- 24-BUS SYSTEM, HVDC LINKS, FUZZY LOGIC CONTROLLER

I. INTRODUCTION

Power system Interconnection is the common thing now a day's which means the connection of various types of Generating stations and loads in a specific area. Instead of connecting a single source to load and delivering power, we have a provision of drawing power from multiple sources at a time. In a power system many disturbance occurs due to the faults. The faults may occur due to the Short circuit (or) Open circuit in interconnected system; this will be effect entire interconnected system of stability.

Generally in a AC power system, Stability most important parameter. In AC power system transient stability occurs due to sudden change of load at load side and light strokes on the transmission lines, the most effect on the at generation station like Alternator. So the emergency control scheme applied on the generation station, means the entire load shedding scheme based on the topological and dynamic characterization of stability boundary is proposed in. In AC power system control schemes are less efficient for control the transient stability. So we are introducing HVDC links system in this interconnected system, we are directing HVDC link between generator to load (or) bus system.

Modeling of AC interconnected system:

Generally now days most important is to all power generating station are interconnected system, because the reliability and stability condition. In interconnected system all generators connected through buses .In buses system to reliability of the entire system will be increase

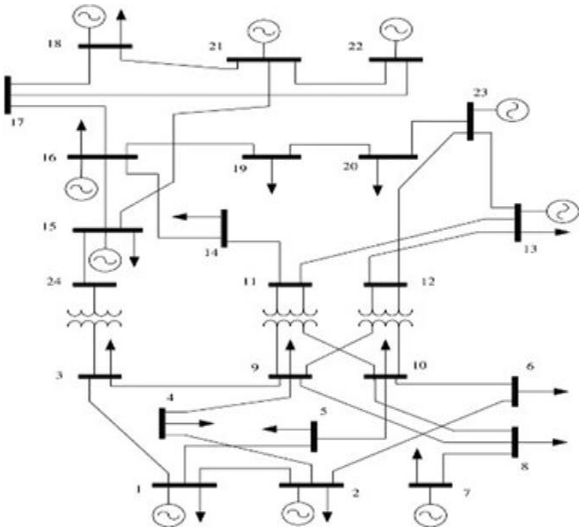


Fig.1. Schematic arrangement of a IEEE 24 bus AC system

In IEEE 24 bus AC system all ten generators are connected through the buses. In ac system suddenly transient occurs due to the sudden load changes and light strokes, the stability of the system changes, means such as loss of synchronism phenomena may occurs. Those phenomena may have for effect to lead in a very short time to the loss of many synchronous generator and, in turn endanger the stability of the whole system. Numerous control schemes have thus been proposed to mitigate loss of synchronism

phenomena .they can be classified into group's 1.Emergency control and 2.Preventive control. whereas preventive control anticipates events to ensure that the power system is to withstand the most critical events and the emergency control is executed immediately means, instantaneous control uses in control system.

II. MODELING OF HVDC LINK STRATEGIES IN IEEE 24 BUS SYSTEM

Usually in Ac system controls like, the emergency control technique uses on the generator and load side action, i.e. load shedding on the load side and power shedding on the generating station side. this will be more effect on the interconnected system. In addition, FACTS devices such as fast valving and breaking resistors, fast excitation controllers, tie-line reactance controllers could be used as mean in emergency control system for control transient stability. The facts devices uses in this control system have facing some problem like increase reactive power in the line or decrees the reactive power in the line and also transmits only limited amount of power sends, on-linear in natural produce harmonics in the output signal.

So in power system introducing HVDC links whereas been installed, for a better alternative could be to use those device as emergency control means. The converting operation (ac/dc) involves no inertia and constant power setting of HVDC link through the line and increase transient stability of the system. Modulating of active power flow through the HVDC line has been proposed to improve power system stability.

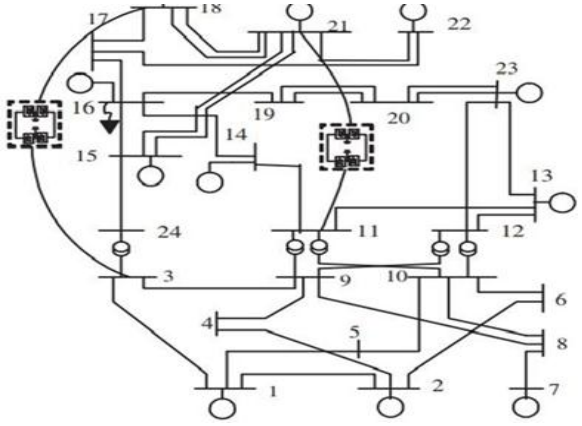


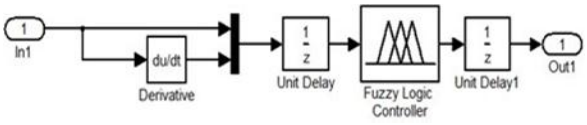
Fig.. Schematic arrangement of a IEEE 24 bus HVDC links

When an HVDC –link replace a Ac line, this alternative is necessary, because in DC transmission link not offers the damping abilities of AC lines when they are operated in a constant power mode. we are proposed in this paper to study how the power flow in HVDC line can be controlled to increase transient stability in the system.

III. CONTROL SCHEME FOR HVDC LINE MODULATION

This paper mainly focuses on control strategies for the HVDC line, where the inputs are based on the different AC variables. It is supposed that those variables are known instantaneously and no information delay is considered. The setting are subjected to limitation with respect to a minimum and maximum value of the power flow.

In this paper we are using two HVDC line and each HVDC line have one controller ,the power flow setting is derived from a specific input e by a fuzzy logic controller which shown in figure



In recent years, the number and variety of applications of fuzzy logic have increased significantly. In conventially controller like PID controllers, the time for controlling is more compare to fuzzy logic and transient stability having in system is more compare to fuzzy logic, so we are preferable in this paper fuzzy logic controller. The performance of the controller is baesd on the proper tunning of the controller parameter

IV. CONTROL STRATEGIES IN HVDC LINE

Four control strategies are considered and their effectiveness is analyzed

A. Strategy 1

With strategy 1, e is equal to zero, i.e. no specific power modulation control is applied to the HVDC system.

B. Strategy 2

With strategy 2.Pdc set is modulated based on the rotor speed of the generators located closest to the

rectifier and inverter buses of the HVDC – link respectively
e = d/dt (Wdcr-Wdci)
where Wdcr and Wdci are the rotor speeds of the rectifier and inverter buses of the hvdc –line .

C. Strategy 3
Pdc set is modulated based on the voltage phase angle at the end buses of the HVDC-link.
e= d/dt(voltage phase angle at the rectifier and inverter side buses of the HVDC link)

D. Strategy 4
PDc set is modulated based on the AC power flow in the inter area tie lines. This control scheme suppose the defintion of well-defined control areas interconnection by the HVDC lines.
e = d/dt(Pia)

V. MODES OF OPERATION IN HVDC LINK

Three modes of operation are designed to compute the power injection from the end buses of the each HVDC link. Under normal condition, the HVDC link operate in constant current power mode when the rectifier operates in constant current control and the inverter operates in constant extinction angle control.

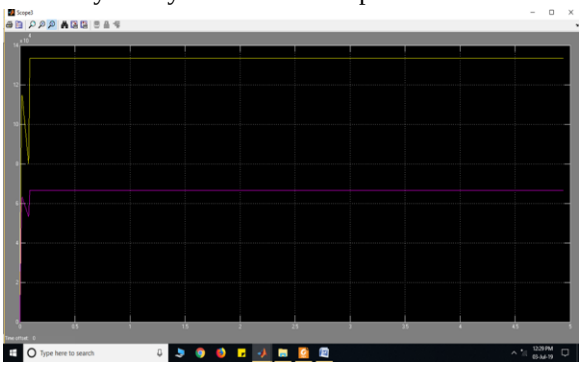
- Mode 1: constant power/current control at the rectifier and constant extinction angle at the inverter.
- Mode 2: Minimum firing angle control at the rectifier and constant power/current control at the inverter.
- Mode 3: Minimum firing angle at the rectifier, and constant extinction control at the inverter.

VI. WORKING EXAMPLE

A three phase to ground fault is applied to bus 19 at t= 100 ms and the fault is cleared by tripping lines 19-16, 19-20 at t= 200ms. As the time frame of interest in transient stability analysis is usually three to five seconds. this study is limited to the first five seconds after the short circuit inception .

VII. SIMULATION RESULTS

Simulation has been carried out on the IEEE 24 bus reliability test system with two bipolar HVDC links.



Power flow through hvdc link with strategy 1

Fig. power flow through the HVDC link with strategy 2

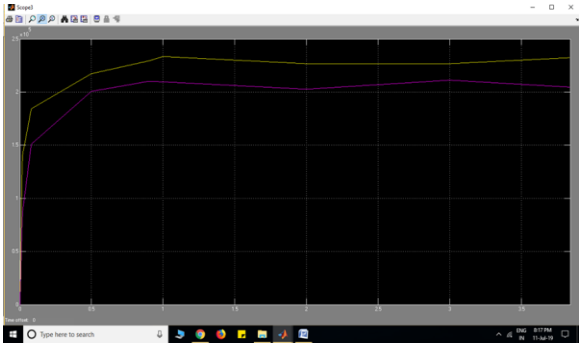


Fig. power flow through the HVDC link with strategy 3

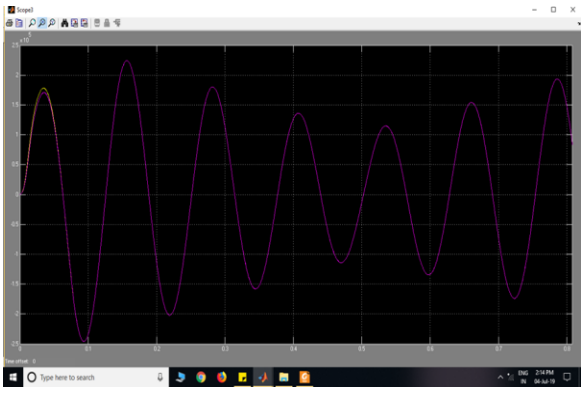


Fig. power flow through the HVDC link with strategy 4

VIII. CONCLUSION

By the process of implementing fuzzy logic method, The transient stability in hvdc link can be controlled by fuzzy logic controller then the system will be perform stability in the system. This further improvement by adding both convention and fuzzy logic controller in this system

REFERENCES

[1] M. Pavella, D. Ernst, and D. Ruiz-Vega, Transient Stability of power systems. Kluwer Academic, 2000

[2] P. Kundur, Power System Stability and Control. McGraw-Hill, 1994

[3] Y. Min, K. Hou, R. Zhang, and Q. Tu, "A new method for generation shedding and load shedding in power system emergency control," in Proc. IEEE International Conference on Electric Utility Deregulation, Restructuring and Power Technologies, vol. 1, April 2004, pp. 210–214.

[4] C. Li, C. Deng, Y. Sun, and X. Chen, "An on-line transient stability emergency control strategy based on PMU forecasted trajectory," in Proc. International Power Engineering Conference, Dec 2007, pp. 807– 812.

[5] D. Ruiz-Vega and M. Pavella, "A comprehensive approach to transient stability control. II. open loop emergency control," IEEE Trans Power System, vol. 18, no. 4, pp. 1454–1460, Nov 2003.

[6] D. Ernst and M. Pavella, "Closed-loop transient stability emergency control," in Proc. IEEE Power Engineering Society Winter Meeting, vol. 1, 2000, pp. 58–62.

[7] M. Glavic, D. Ernst, D. Ruiz-Vega, L. Wehenkel, and M. Pavella, "ESIME - a method for transient stability closed-loop emergency control: achievements and prospects," in Proc. iREP Symposium- Bulk Power System Dynamics and Control - VII,Revitalizing Operational Reliability, Aug 2007, pp. 1–10.

[8] R. Patel, T. S. Bhatti, and D. P. Kothari, "A modified approach to transient stability enhancement with fast valving and braking resistor applications," Int J Electrical Power & Energy Systems, vol. 28, no. 10, pp. 729–738, Dec 2006.

[9] N. Fernandopulle and R. Ramshaw, "Domain of stability of a synchronous machine with excitation control-a cell mapping approach," Electric Power Systems Research, vol. 27, no. 3, pp. 173–181, Aug 1993.

[10] D. K. Reitan and N. Ramarao, "A method of improving transient stability by bang-bang control of tie-line reactance," IEEE Trans Power Apparatus and Systems, vol. PAS-93, no. 1, pp. 303–311, Jan 1974