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Load frequency control of three area power system using PID tuning by Ziegler Nichols(Z-N) method

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Abstract *—In this paper,a brief study of the different control strategies used) for tuning of PID controller.The conventional PID is replaced by(1) Z-N tuning PID controller and (2)Fuzzy logic controller(FLC) Load frequency control is generally used to maintain the balance between generation side and load side.This type of control is used for each area by means of speed control.The main objective of load frequency control(LFC) is to decreasing steady state and transient error to "0".This paper describes LFC with time delays using simulation results in Matlab/simulink environment.*

Keywords- LFC(load frequency control),PID controllers,Z-N tuning,Power system.

I. INTRODUCTION

Mainly there are two parameters which play vital role in power system stability,that is voltage and frequency.Frequency is more depends upon active power and similarly voltage is more depends upon the reactive power.So the control difficulty in the power system may be divided into two parts.

One is related to the control of the active power along with the frequency whereas the other is related to the reactive power along with the regulation of voltage.

The control of generation and frequency is commonly referred to as load frequency control.

A Power system is a combination of generation,transmission,distribution and loads. Load Frequency control is an important task in electrical power system design, operation ,control.A power system requires that generation and load closely balance moment by moment adjustments to the output of generators are necessary.The main purpose of load frequency controllers is to ensure the stable and reliable operation of power systems. Load frequency control in power system introduce as one of the most important things in order to provide reliable electrical power with better quality.

OBJECTIVES OF LFC IN POWER SYSTEM.

- *As with change in load on system occurs then freq. deviation will arise in the power system.*
- *Ultimate aim of ALFC is to maintain desired real power output of synchronous generator unit and to assist the process of frequency control of interconnected N/W.*
- *ALFC also helps in meeting the specified power changes among the member of interconnections.*

PID controller:

This controller has three parameters Kp,Ki and Kd(proportional gain, integral gain, derivative gain).Setting of these parameters will improve the response of the system ,increase system stability ,reduce overshoot, eliminate steady state eroor.

T.F of PID controller is given as below;

C(s)= Kp + Ki/s +Kds

.The PID controller is shown in Fig.

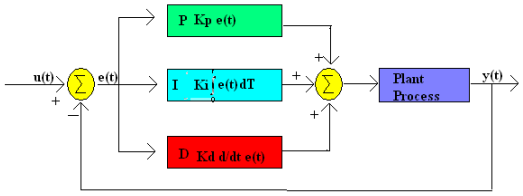

Fig 1.0 , PID controller

PID is most commonly used feedback controller that calculates an error value as the difference between measured value and desired value.

The parameters data for three area power system are given below table,

AREA -1	AREA-2	AREA-3
R1=2.4	R2=2.4	R3=2.4;
Ts1=0.08	Ts2=0.08	Ts3=0.08
Tt1=0.28	Tt2=0.28	Tt3=0.28
Tp1=18	Tp2=18	Tp3=18
Kp1=120	Kp2=120	Kp3=120
T12=0.06	T21=0.06	T31=0.08
T13=0.08	T23=0.06	T32=0.06
Ki1=0.014	Ki2=0.014	Ki3=0.014
B1=0.425	B2=0.425	B3=0.425

Table 1:Parameters data

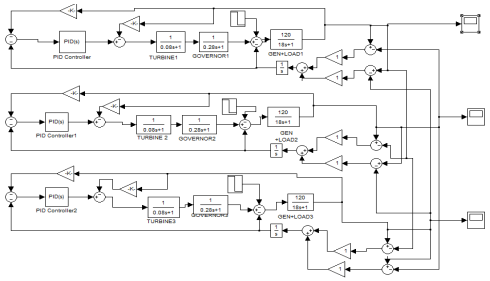

Fig1.1,(Simulation model of three area power system using PID controller)

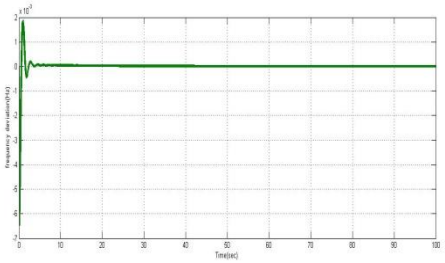

Fig 1.2 Frequency deviation for area-1 using PID controller

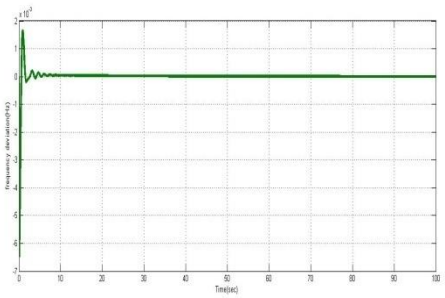

Fig 1.3,Frequency deviation for area 2 using PID controller

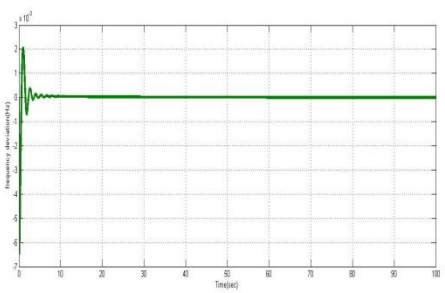

Fig 1.4,Frequency deviation for area-3 using PID controller.

Ziegler Nichols Method:

This methodology was proposed by Ziegler and Nichols in 1942.. Z-N PID Controller is controlling the plant or system by continuously monitoring plant output which is known as process value with the desired process value known as set point of the system.The PID controller calculates on the difference between process value and set point is called as an "error".

There are two types of Ziegler-Nichols tuning rules:
(1)closed loop method:It can be referred if the system is both over-damped or under-damped.
(2)Open loop method:It can be referred when the system is over damped.
The simulation model for three area power system using PID tuning by closed loop Z-N method is shown in above figure 1.3

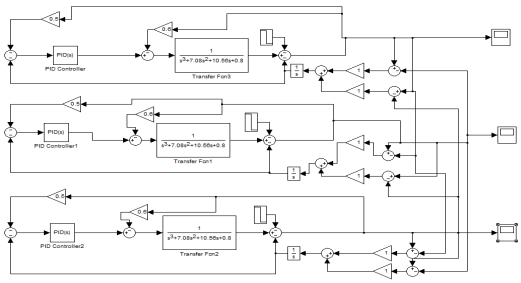

Fig 1.5 Model for three area system using PID tuning by closed loop Z-N.

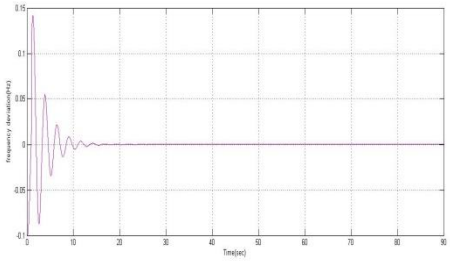

Fig 1.6,Frequency deviation for area-1 using PID+ZN

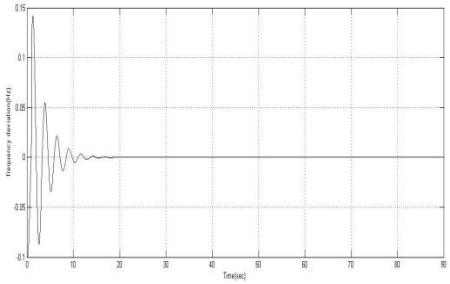

Fig 1.7 Frequency deviation for area-2 using PID+ZN

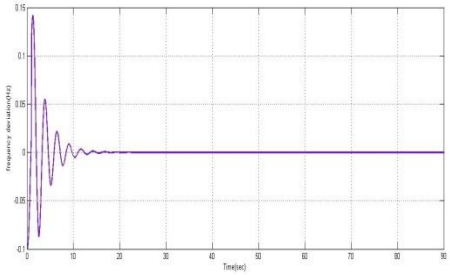

Fig 1.8 Frequency deviation for area-3 using PID+ZN

From the above simulation results,we can compare settleing time of (1)conventional PID and (2) ZN-PID

TABLE:2 Comparison of different controller's setteling time,

Controller	Area 1	Area 2	Area 3
ZN-PID	20 sec	19 sec	20 sec
PID	23 sec	35 sec	30 sec

Table 2:Comparison of setteling time

CONCLUSION

In this paper, design of PID controller using ZN technique is used for control higher order process, result shows that ZN-PID gives better dynamic performance over conventional PID. The output of the load change was controlled with less short settling time using the ZN-PID based controller.

REFERENCES

(1) Ashok singh 1, Rameshwar singh 2, Load-Frequency Controller of electrical Power plant using Ziegler-Nichols (ZN) tuning controller, IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 6, August 2014

(2) Hadi Saadat,"Power system Analysis"

(3) Prabha Kundur,"Power system stability and Control"

(4) Rajkumar Bansal1, A.Patra2, Vijay Bhuria3, " Design of PID Controller for Plant Control and Comparison with Z-N PID Controller", International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, Volume 2, Issue 4, April 2012

(5) Rajeev Kumar1, Sunil K. Singla2, Vikram3, "A Comparative Analysis of different Methods for the tuning of PID Controller", International Journal of Electronics Communications and Electrical Engineering ISSN : 2277- 7040 Volume 3 Issue 2 (February 2013)

(6) J.C.Basilio,S.R.Matos,"Design of PI and PID controllers with Transient Performance Specification", IEEE Trans. On education,vol.45,NOVEMBER_2002