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Modeling and Simulation of Lfc and Aver with Pid Controller.

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ABSTRACT: *In this study, the terminal voltage and frequency responses1u of Automatic Voltage Regulator (AVR) and load frequency control with different proportional gains were analyzed, load frequency controller is use to maintain zero steady state error in a interconnected power system while the AVR control machine output voltage within specified limit. A Proportional Integral Gain controller was introduced to the system and a response with minimum overshoot with a very small settling time was obtained after simulation. The simulations results demonstrate the effectiveness of the designed system in terms of reduced settling time, overshoot and oscillation.*

KEY WORDS: *Automatic voltage control, Load frequency control, PID controller.*

I. INTRODUCTION

In a power system, load frequency control (LFC) and Automatic voltage regulator (AVR) plays an essential role to allow power exchanges and regulate generator voltages for consumers. LFC in a power system can boost the system performance and bring stability on frequency or voltages. LFC in power system is very important in order to supply reliable electric power with good quality and the goal is to reduce the steady state error to zero in a interconnected power system [1]. The AVR on the other hand controls the power fed to the exciter field, and hence the main field, to maintain the machine output voltage within specified limits. A voltage measuring circuit continually monitors the generator output and provides output under speed protection of the excitation system [2] In this work the performance of AVR and LFC with different proportional gain in a power system was simulated and the analyzed. In an interconnected power system load frequency controller installed for each generator. The controller is set for a particular operating condition and takes care of small changes in load demand to maintain the frequency and voltage magnitude within the specified limits. Small changes in real power are mainly dependent on changes in the rotor angle and thus the frequency. The reactive power mainly dependent on the voltage magnitude. The cross coupling between the load frequency control loop and AVR loop is negligible and the load frequency control and voltage control are analyzed independently [3]. Power systems are divided into control area connected by tie lines. Each area needs its system frequency to be controlled. Hence LFC system uses the proportional integral (PI) controllers in practice [4] .A good quality of the electric power system requires both the frequency and voltage to remain at standard values during operation. It will be impossible to maintain the balances of both the active and reactive power without control. As a result of the imbalance, the frequency and voltage levels will be varying with the change of the loads. Thus, a control system is essential to cancel the effect of the random load changes and to keep the frequency and voltage, at standard values [5].Although the active power and reactive power have combined effect on the frequency and voltage, the control problem of the frequency and voltage can be decoupled. The frequency is highly dependent on the active power while the voltage is highly dependent on the reactive power. The active power and frequency control is referred to as load frequency control (LFC).

II. METHODOLOGY

To study a system, it is sometimes possible to experiment with the system itself. The objective of the system studies is to observe the performance of LFC and AVR in a power a system.

In this work two different cases were solved and the simulink models were used to obtain the simulation result using MATLAB program. The reason of considering two different cases is to:

1) To observe the performance of AVR alone in a power system.
2) To observe the performance of both AVR and LFC in a power system.
3) As a beginner it is easy to study the system one after the other.

2.1 CASE 1

Fig (1) shows the block diagram of an AVR and PID controller is added in forward path. the proportional gain(P) has settled to 1.0,which the integral gain(ks)and derivative gain(kd) were adjusted until a step response with minimum overshoot and a very small settling time is obtained. An integral gain of K_I=0.25 and derivative gain (K_D) of about 1.4seconds with a negligibly small overshoot, this PID controller reduces the steady state error to zero. The simulation result for the above setting is shown in Fig (3).

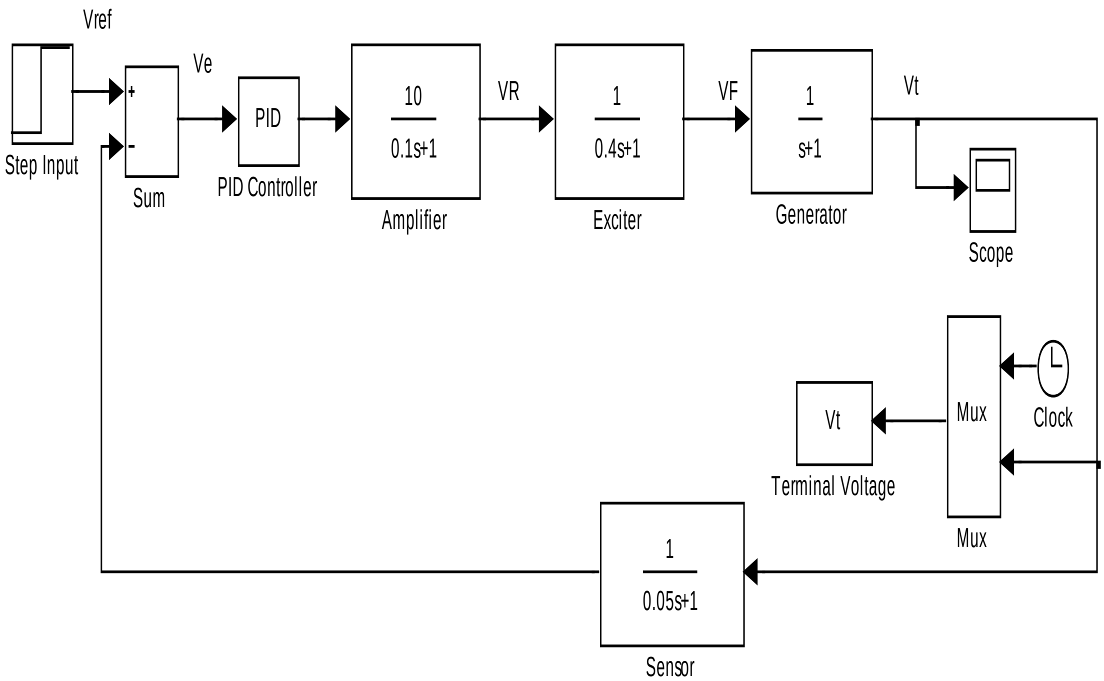

Figure1: Simulink block for case(1)

2.2 CASE 2

A model for combined LFC and AVR system is considered and a combined simulation block diagram is constructed.

An isolated power station has the following parameter [6].

Table 1.0

	Gain	**Time constant**
Turbine	KT=1	**Tt=0.5**
Governor	Kg=1	**Tg=0.2**
Amplifier	Ka=10	**Ta=0.1**
Exciter	Ke=1	**Te=0.4**
Generator	Ka=0.8	**Ta=1.4**
Sensor	Kr=1	**Tr=0.05**
Inertia	H=5	
Regulator	**R=0.05**	

The load varies by 0.8 percent for a 1.0 percent change in frequency, the synchronizing coefficient is 1.5 and the voltage coefficient is 0.5. Also, the coupling constant are K2=0.2, k4=1.4 and k5=-0.1, a combined simulink block diagram was constructed as shown below. Frequency deviation and terminal voltage response for a load change of PL= 0.2 per unit was obtained. The integrator gain in the secondary LFC loop is set to 6.0. The excitation PID controller is turned for KP=1, ki=0.25 and KD=0.3.

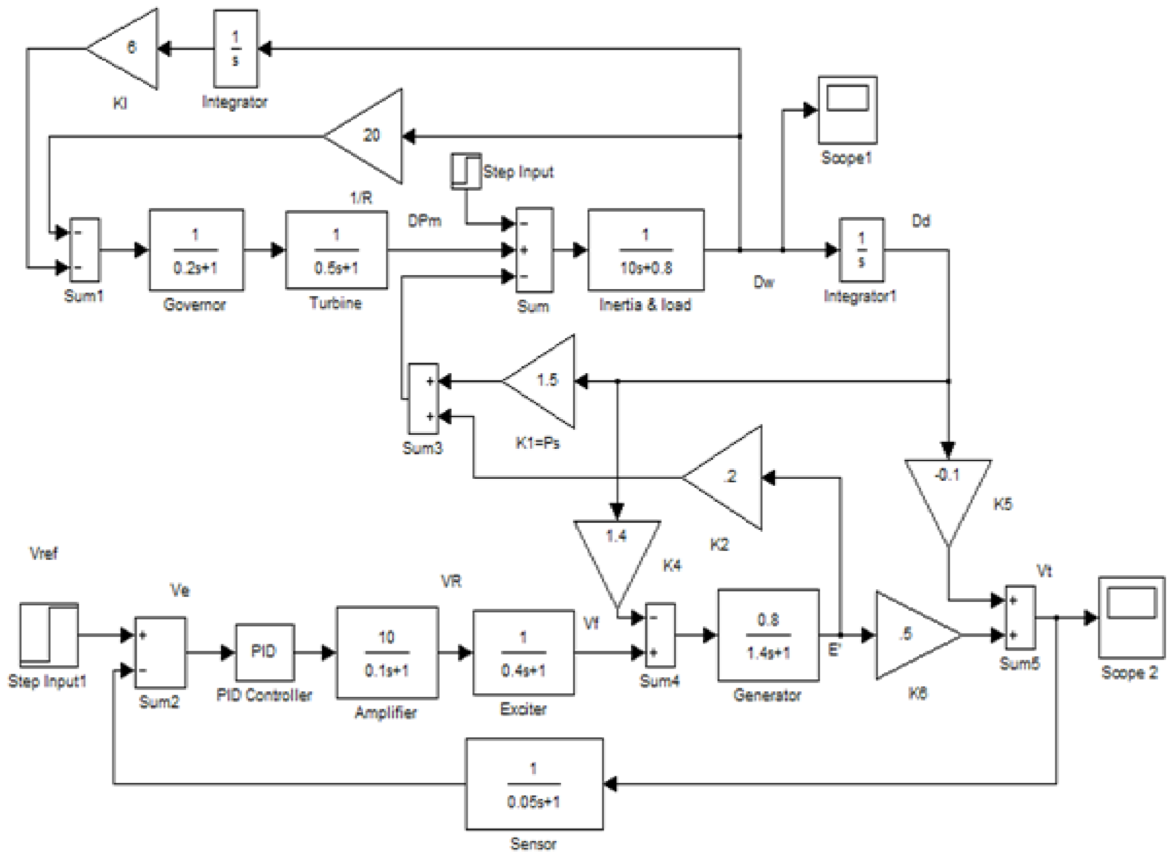

Figure2: Simulink block for case(2)

III. SIMULATION RESULT

3.1 case 1:

The simulation was done using simulink packages available in MATLAB 7.1 the LFC and AVR was simulated using PID controller for different value of load and regulation.

Table 1.0

Proportional gain	K_I	K_D	Overshoot	Settling Time(s)
1.0	0.25	0.28	0.925	1.4

In Fig (3) below the terminal voltage response for change in load and regulation were obtained. It could be observed that the response settles in about 1.4seconds with very small overshoot of about 0.925.this result indicate that the PID controller reduces the steady state error to zero. It is observed that the settling time of AVR with PID controller is very less and there is no transient peak overshoot.

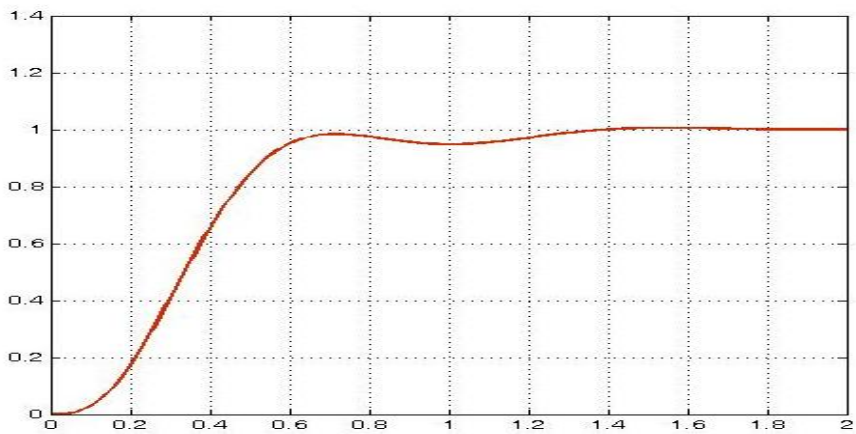

Figure 3: Terminal voltage step Response

3.2 Case 2

In figure (4) and (5) below, present the simulation result for LFC and AVR. the frequency and terminal voltage response are presented in fig (4) and fig(5) .in fig (4) very small settling time and overshoot is observed. Also in fig (5) the overshoot is about 0.98 with a settling time of 10seconds.the result indicate that there is small change in transient response when the coupling coefficients are set to zero.

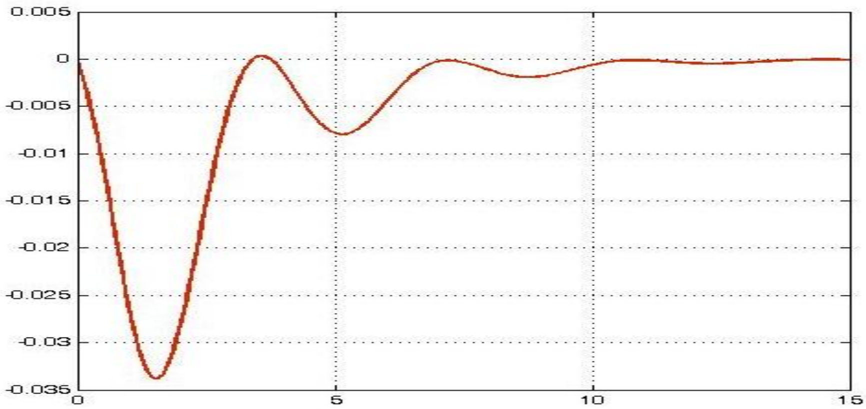

Figure 4: frequency deviation step response

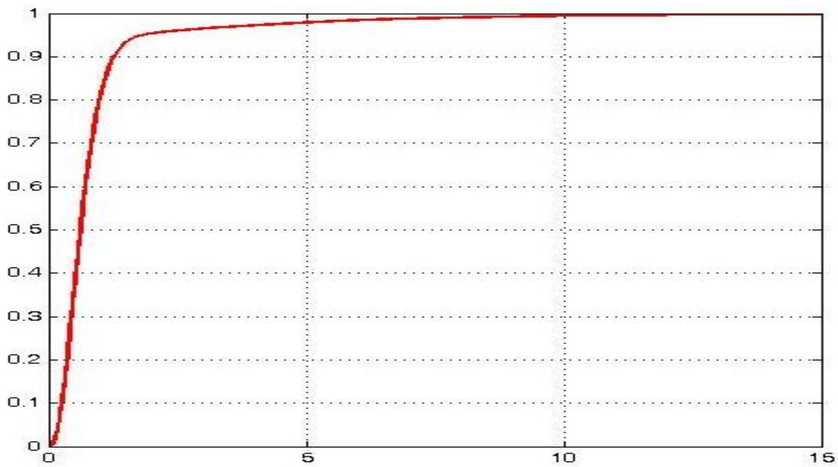

Figure 5: Terminal voltage step response

The result in figure (4) and (5) also indicate that the LFC and AVR with PID controller shows enhanced performance characteristics with respect to settling time, oscillation and overshoot. The frequency deviation and terminal voltage response were obtaining using MATLAB computer program (Hadi saadat, 2002)

IV. CONCLUSIONS

The quality of power supply is determined by constancy of frequency and voltage. Minimum frequency deviation and good terminal frequency response are the characteristic of a reliable power supply. The LFC control real power and frequency and AVR loop control reactive power and voltage. Proportional integral derivative controller has been incorporated in a typical power system configuration to control the voltage and frequency. It can be concluded that, the PID controllers provide a satisfactory stability between frequency overshoot and transient oscillations with zero steady state error. The simulation results demonstrate the effectiveness response

REFERENCE

[1]. Nagrath and Gopal, control system engineering,2008
[2]. P Kundar, power stability and contrlo, 1998.
[3]. Katsuliku Igata, modern control engineering, fouth edition, 2000
[4]. Zwe-lee gain, A particle swarm optimization approach for optimum design of PID controller in AVR system, vol 19, 2004.
[5]. Nagrath and Gopal, control system engineering, 2008
[6]. S. Sumathu, Ga based PID for load frequency control, 2009 vol.1 no. 2
[7]. Hadi Sa'adat, modern power system, Tata Mcgraw hill, 2002

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