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Effect of Mechanical Starting Time on Single Area LFC

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ABSTRACT-
Single area power system is interconnection of governor, turbine and load. Primary load frequency is done with droop characteristics. Primary load frequency control has static and dynamic features. One of the basic objectives of the loop is to maintain constant frequency in spite of changing loads. The static response of the load frequency control yield important information about frequency accuracy. The dynamic response of the loop will inform about tracking ability and stability of the loop. This paper investigates the effect of mechanical starting time on single area power system and maintain frequency deviation.

Key Words-Single area power system, mechanical starting time, Simulink

I. INTRODUCTION

A well designed power system is composed of several control areas that are connected with each other through tie lines. For satisfactory operation of a power system, the frequency should remain nearly constant i.e. frequency deviation should be zero. Frequency needs to be maintained constant because loads and other electrical equipments are usually designed to operate at a particular frequency i.e. 50 Hz. Off-nominal frequency operation causes electrical loads to deviate from the desired output. Relatively close control of frequency ensures constant of speed of induction and synchronous motors. The frequency of a power system is dependent on active power balance. As frequency is a common factor throughout the system, a change in active power demand at one point is reflected thought the system by a change in frequency [1].

As active power load changes, the frequencies of the areas and tie-line power exchange will deviate from their scheduled values accordingly. As a result, the performance of the power system will decline. In electric power generation, system disturbances caused by load fluctuations results in changes to the desired frequency value. Load Frequency Control (LFC) is a very important issue in power system operation and control for supplying sufficient and both good quality and reliable power. The basic aim of load frequency control is to maintain desired megawatt output of a generator unit and assist in controlling the frequency of larger interconnection. LFC controls during normal (small) changes and abnormal changes in load and frequency [2].

II. MODELLING OF SINGLE AREA POWER SYSTEM

Load frequency control analysis consists of several elements such as governor, turbine power system. Load frequency control explains consider single area power system [3,4].

A. GOVERNOR

Governors are used in power systems to sense the frequency bias caused by the load change and cancel it by varying the inputs of the turbines [5]. Governor is expressed as transfer function

$$G_g(s) = \frac{\Delta P_V}{\Delta P_g} = \frac{1}{1 + sT_g}$$

T_g is time constant for governor and its value is typically around 0 .1sec.

B. TURBINE

A turbine unit in power systems is employed to transform the natural energy (steam energy and energy obtained from steam) into mechanical power that is supplied to the generator [7]. Generally, Steam and hydraulic turbines are use in power system for design of load frequency control (LFC)

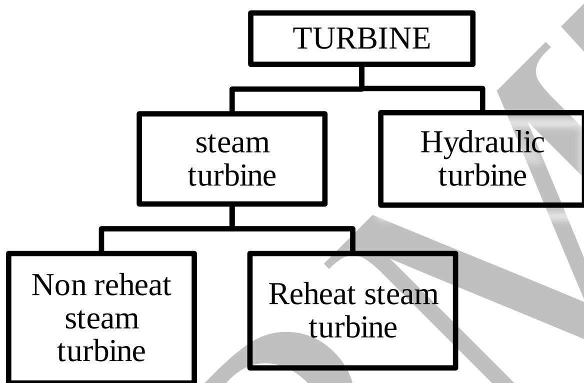

Fig.1 Type of Turbine used in power system

This equation represent transfer function of non- Reheat turbine. This equation is written as

$$G_t(s) = \frac{1}{1 + sT_T}$$

C. MACHINE

The equation of motion in power system stability analysis is rotational inertia equations describing the effect of unbalance between the electromagnetic torque and mechanical torque of the individuals [9].

Using equation of motion of a synchronous machine to small disturbance, the equation writes as:

$$\frac{2H}{w}\frac{d^2\delta}{dt^2} = \Delta P_m - \Delta P_e$$

Taking the Laplace transformation of equation

$$\Delta W_r(s) = \frac{1}{2Hs}(\Delta P_m - \Delta P_e)$$

D. LOAD

The load on the power system consists of a different electrical drives. The devices used for lighting purposes are basically resistive in nature and the rotating devices are combination of resistive and inductive load [10]. The speed-load characteristic of the total load is given as

$$\Delta P_e = \Delta P_L + D\Delta f$$

Where, ΔP_L is frequency depend load deviation DΔf is the frequency depend load deviation D is expressed as % change in load by % change in frequency. Typical values of D are 1 to 2 percent

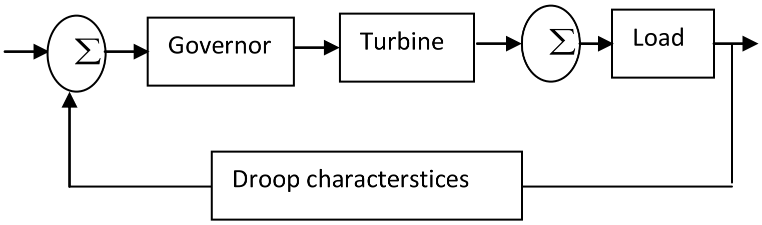

Fig.2 Single area power system

III. SIMULINK MODEL OF SINGLE AREA POWER SYSTEM

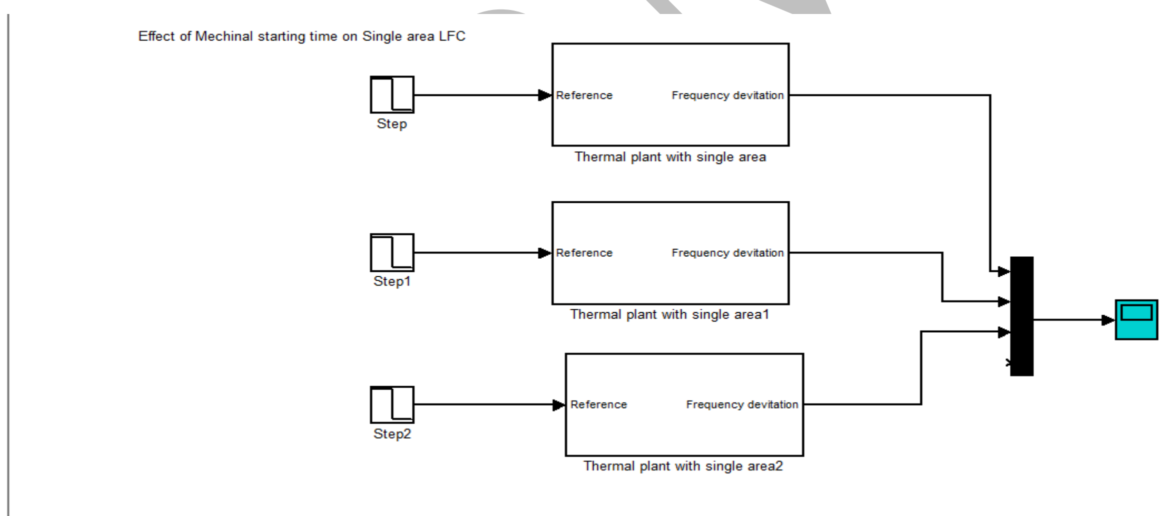

Fig.3 Simulink Model of sinle area power with mechanical starting time

IV. RESULT

Simulation result show that as mechanical starting time increase as overshoot of system increase. Frequency deviation of system is increase by increase the mechanical starting time. Therefore, Frequency deviation of system is control by varies the mechanical starting time.

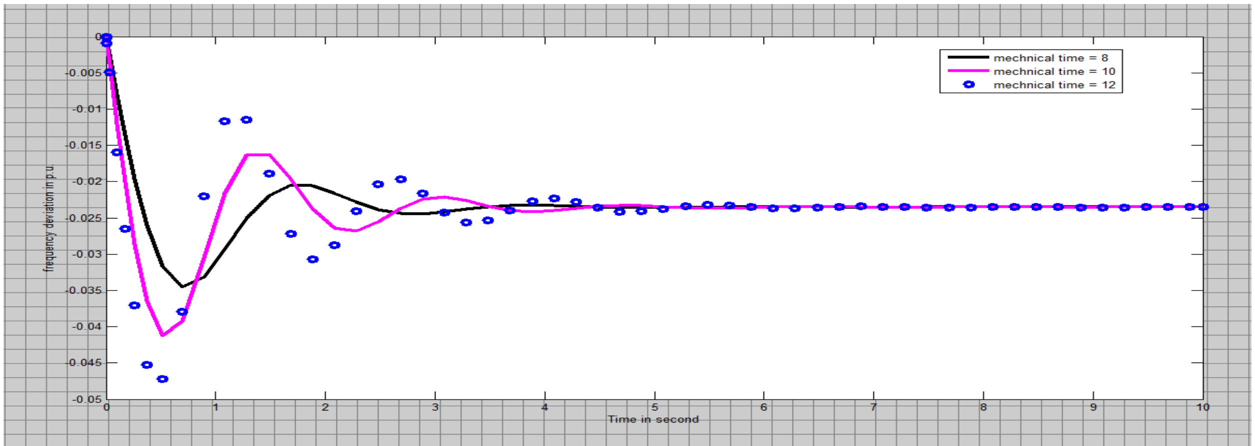

Fig.4 Effect of mechanical time on single area power system

REFERENCE

1. P. Kundur, Power System Stability and Control. Mc Graw-Hill, 1994.
2. N. Jaleeli, L.S. Vanslyck, D. N. Ewart, L. H. Fink, and A. G. Hoffmann, "Understanding Automatic Generation Control", IEEE Transaction on Power System, vol. 7, no. 3, pp.1106-1122, Aug. 1992.
3. P. K. Ibraheem and D. P. Kothari, "Recent Philosophies of Automatic Generation Control Strategies in Power Systems", IEEE Transaction on Power Systems, vol. 20, no. 1, pp. 346-357, Feb. 2005.
4. K. Tomsovic, D. E. Bakken, V. Venkatasubramanian , and A. Bose, "Designing the Next Generation of Real-time Control, Communication, and Computations for Large Power Systems", in Proceedings of the IEEE, vo. 93, no. 5, pp. 965-979, May 2005.
5. B. H. Bakken and O. S. Grande, "Automatic generation control in a deregulated power system," IEEE Trans. Power Syst., vol. 13, no. 4, pp. 1401–1406, Nov. 1998
6. Elgerd O. I. 1971. Electric Energy System Theory; An Introduction, Mc Graw Hill
7. CL Wadhawa " Electric Power System" New Age International Pub. Edition 2007
8. H. Shayeghi, HA Shayanfar & A Jalili, "Load frequency control strategies: A state-of-the- art survey for the researcher" Energy Conversion and management 50, pp 344-353, ELSEVIER, 2009.
9. C. E. Fosha and O. I. Elgerd, "The megawatt-frequency control problem: A new approach via optimal control theory," IEEE Trans. Power App. Syst., vol. PAS-89, no. 4, pp. 563–567, 1970
10. R. K. Cavin, M. C. Budge, and P. Rasmussen, "An optimal linear system approach to load frequency control," IEEE Trans. Power App. Syst., vol. PAS-90, no. 6, pp. 2472–2482, 1971
11. M. Calovic, "Linear regulator design for a load and frequency control theory," IEEE Trans. Power App. Syst., vol. PAS-91, no. 6, pp. 2271–2285, 1972.
12. W. Tan, J. Liu, T. Chen, and H. J. Marquez, "Comparison of some well-known PID tuning formulas," Comput. Chem. Eng., vol. 30, no. 9, pp. 1416–1423, 2006.
13. W. Tan, T. Chen, and H. J. Marquez, "Robust controller design and PID tuning for multivariable processes," Asian J. Control, vol. 4, no. 4, . 439–451, 2002.