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Study of Automatic Generation Control Of two area thermal-thermal system with GRC and without GRC

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Abstract- **In this paper presenting the critical literature review and an up-to-date bibliography on the AGC (automatic generation control) of power system. Various control aspects concerning the AGC problem have been highlighted. Simulation of AGC schemes based on an interconnected two area thermal-thermal system with generation rate constraints (GRC) and without GRC are studied using MATLAB. Better simulation results of power system shown in case of without GRC .**

Keywords-Automatic generation control, Generation rate constraints, load frequency control.

I. Introduction

One of the most important components in the daily operation of an electrical power system is the scheduling and control of generation. This function is the primary concern of the Energy Control Centre, and is largely provided by an Automatic Generation Control (AGC) program implemented as part of the Energy Management System (EMS). Although the process is highly automatic, power system dispatchers can interact with it by monitoring its results and inputting data that reflect the current operating conditions.

In general, electrical power systems are interconnected to provide secure and economical operation. The interconnection is typically divided into control areas, with each consisting of one or more power utility companies. The control areas are connected by transmission lines commonly referred to as tie-lines and the power flowing between control areas is called tie-line interchange power. One of the main responsibilities of each connected area is to supply sufficient generation to meet the load demand of its customers, either with its own generation sources or with power purchased from other control areas. In this Integral controller is used. The integral term adds a pole at origin resulting in increasing the system type and therefore reducing the steady state error[1]. The main objective of automatic generation controller is to maintain the balance between the generation and demand of a particular power system.

II. Literature Survey

Automatic generation control scheme consists of many subsystems such as load frequency control, voltage control, economic dispatch control etc.

The main objective of power system operation and control is to maintain power with an acceptable quality. The problem of the load frequency control has been one of the most emphasizes topic in the interconnected power systems. Literature shows that C.Concordia and L.K.Kirchmayer et al have done a lot of work on LFC. The authors studied effect of speed governor deadband on tie-line power and frequency control performance [2]. The milestone work on LFC of power systems is done by Olle I. Elgerd and Charles E. Fosha. The revolutionary optimal control concept for AGC regulator designs of interconnected power systems was initiated by Elgerd [3],[4].]. In [4] they developed a dynamic system model of the multi-area electric energy system suitable for study of the megawatt-frequency control problem. Power system is a nonlinear, complex system and is subjected to different kinds of events. Therefore, it is difficult to effectively solve the significant power system control problems depending only on the conventional approaches. Recently, many different control algorithms have been proposed for LFC [5], [6] in order to overcome limitations of the PI controller e.g. model predictive control [7].

III. AGC Thermal-Thermal Simulink model

Fig.1 shows the transfer function model of a two area thermal-thermal system. The dynamic model of the system in the state space form obtained from the transfer function model is

$$= AX + BU + \Gamma p$$

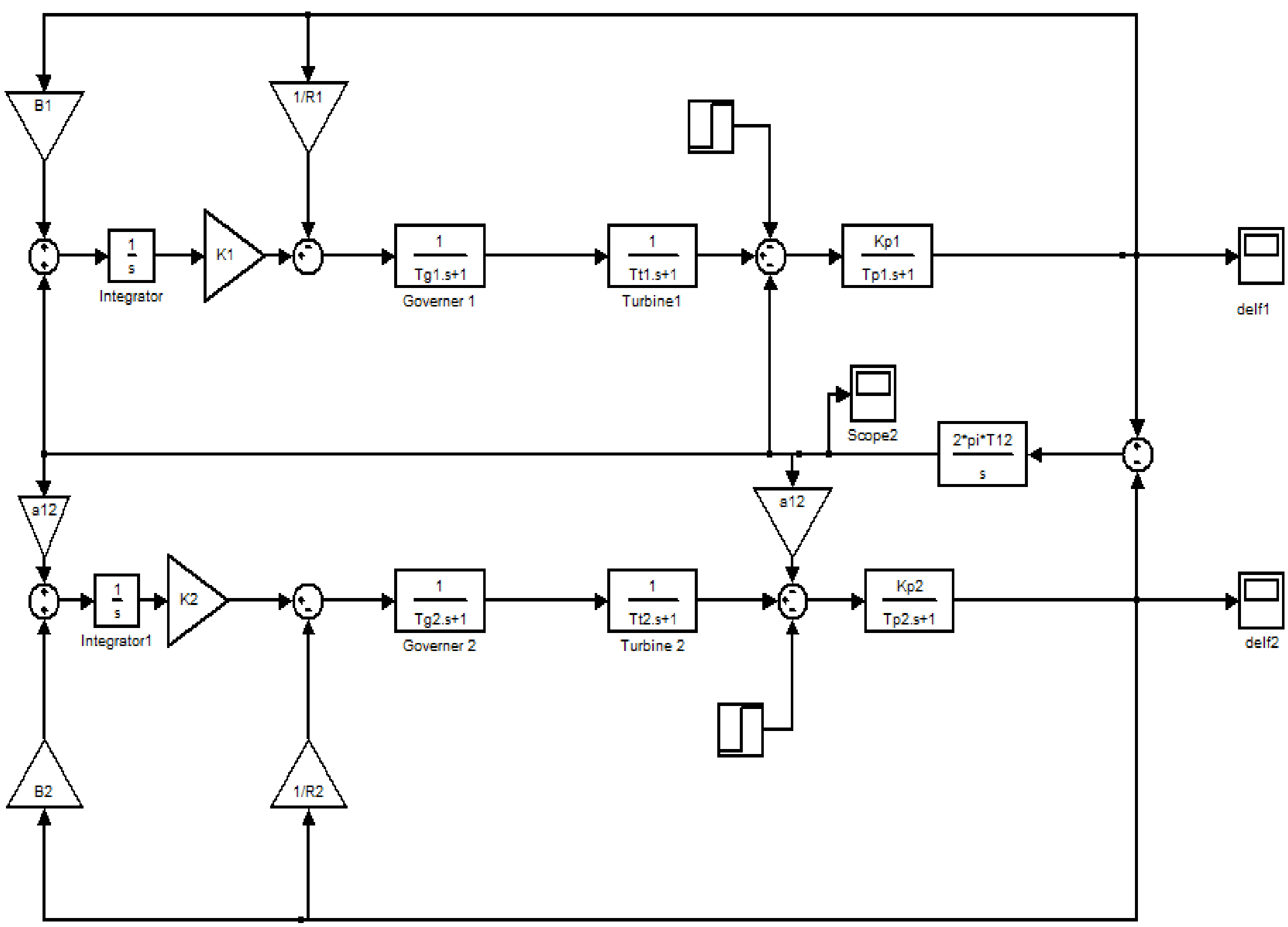

Fig. 1. Transfer function model of an interconnected two-area thermal-thermal system without GRC

where X, U, p are state, control and disturbance vectors respectively. A, B and Γ are compatible matrices and depend on system.

Objective of this paper is which system is better by considering the effect of GRC and without GRC

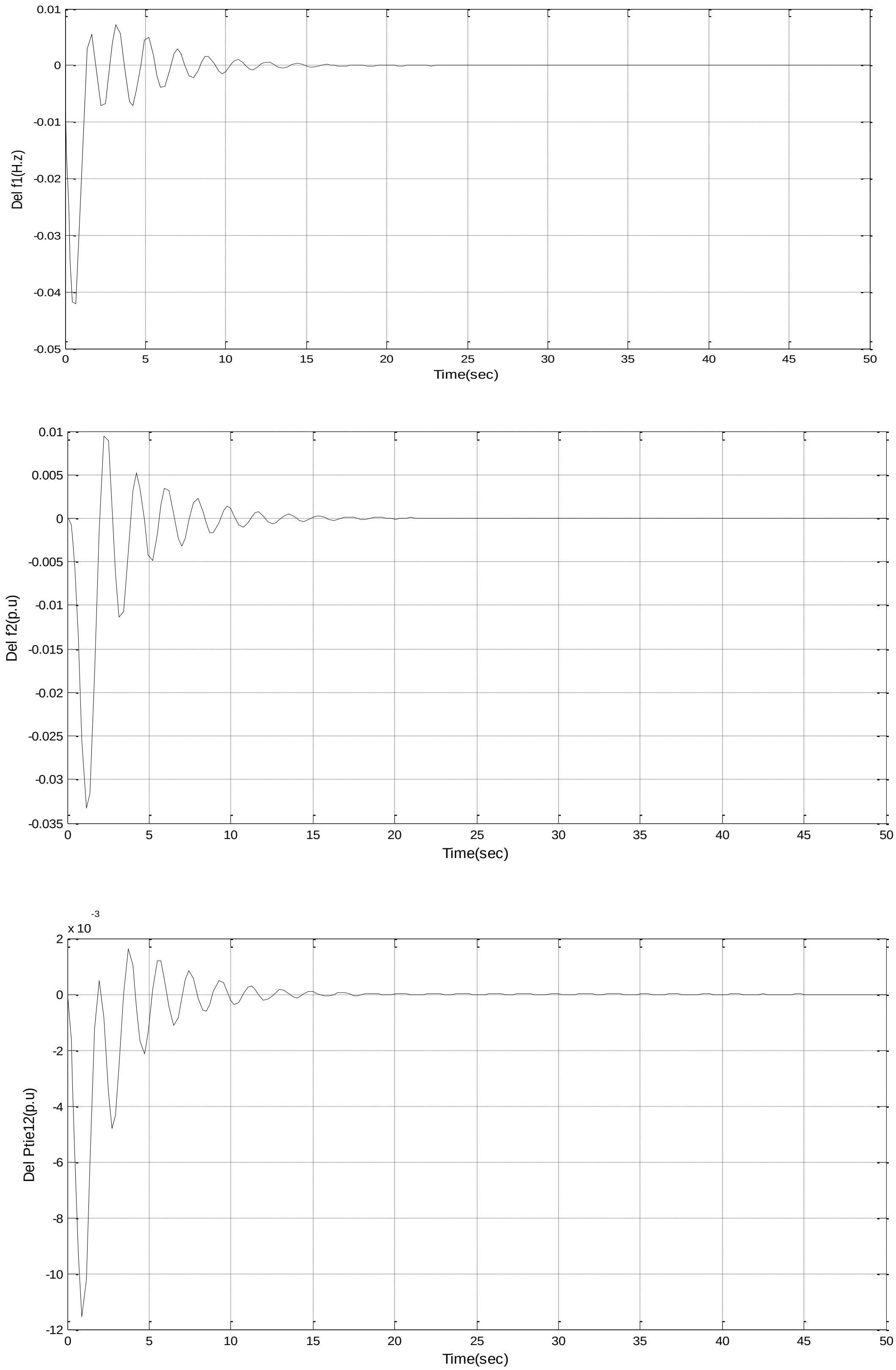

Fig. 2. Simulation result of interconnected thermal-thermal system without GRC

In fig. 3 GRC is considered. In practice small value of R is considered for the primary control loop to achieve better dynamic response[11] .In this small value of R is considered with the effect of GRC.

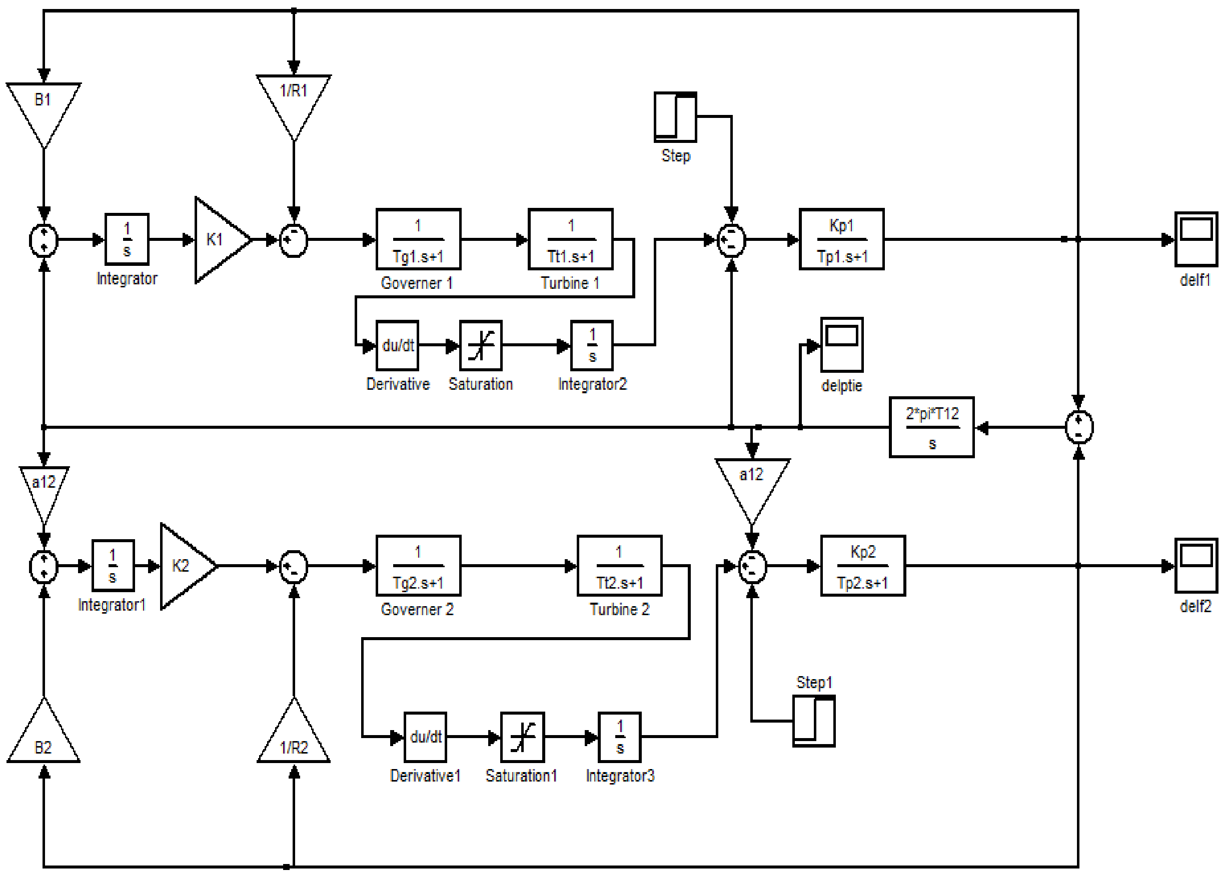

Fig. 3. Transfer function model of an interconnected two-area thermal-thermal system with GRC

The successful operation of interconnected power systems require the matching of total generation with total load demand and associated system losses. There are two variable of interest, namely, frequency and tie line power exchanges. There variations are weighted together by a linear combination to a single variable called the ACE(area control error). One of the objectives that AGC must satisfy may be the system safety requirement, requiring lengthy calculations, large computing system memory space, etc

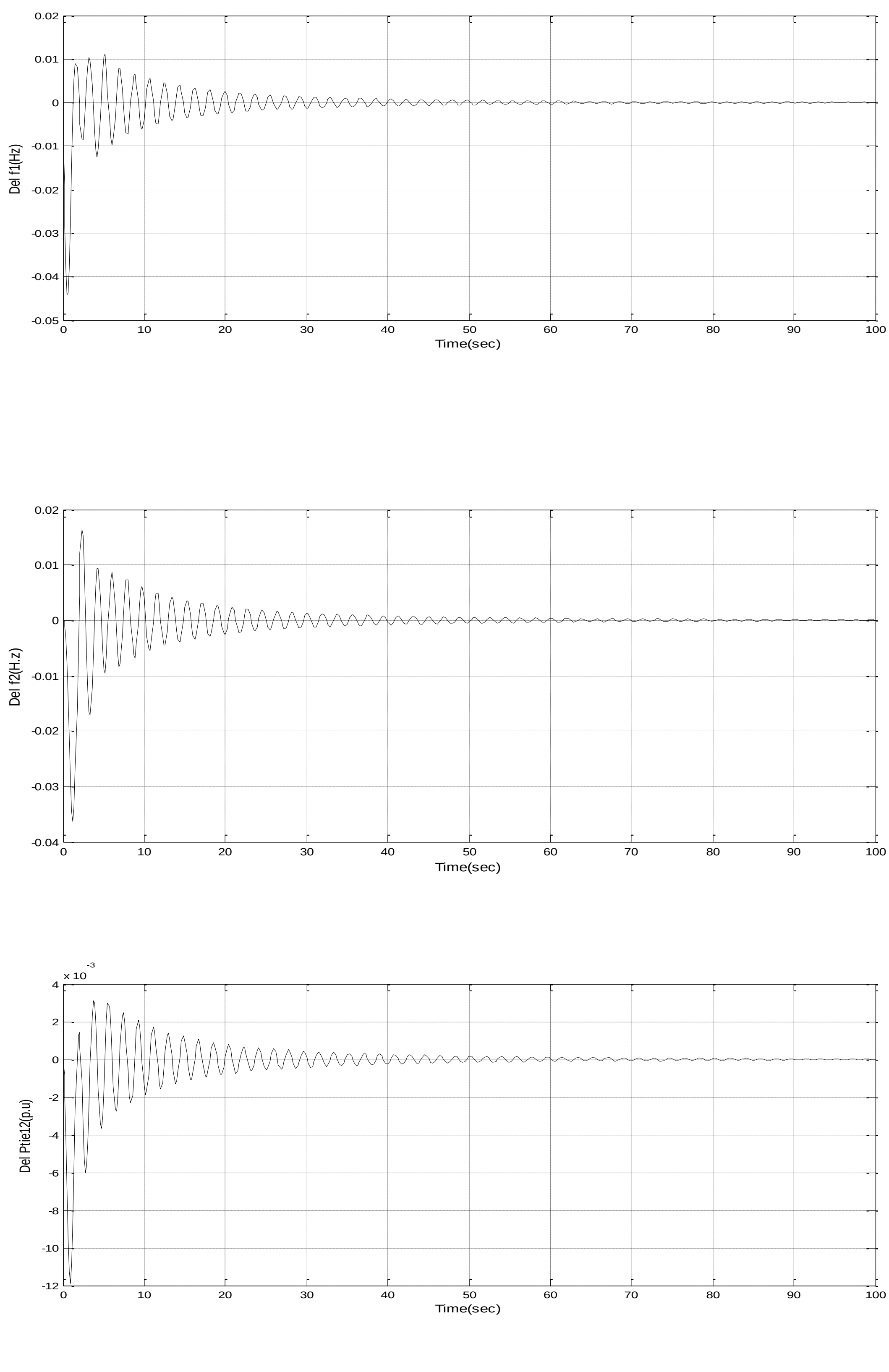

Fig. 4. Simulation result of interconnected thermal-thermal system with GRC

IV. Conclusion

In this paper simulink thermal thermal model of AGC is shown using integral controller. In this, the model is simulated by considering the effect of GRC and without GRC. As per the simulation results shown in fig. 2 and 4 concluded that without GRC gives the better result.

V. Appendix

Nominal system parameters of the two area thermal system investigated:
Tg1=Tg2=0.08s;Tt1=Tt2=0.3s; Kp1=Kp2=120Hz/puMw;Tp1=Tp2=20s; R1=R2=2.4Hz/puMw; a12 = -1; K1=-0.671; K2= -0.671; B1=B2=o.425.

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VII. Nomenclature

f_i Nominal system frequency of i^{th} area. [H_Z]

Δf_i Incremental frequency deviation of i^{th} area. [H_Z pu]

T_{si} Speed governor time constant of i^{th} area [sec.]

K_{gi} Gain of speed governor of i^{th} area

R_i Governor Speed regulation of the of i^{th} area [H_Z /pu.MW]

Tti Governor Speed regulation of the of i^{th} area [H_Z /pu.MW]

Kti Gain of turbine of i^{th} area

K_{pi} Gain of power system (generator load) of i^{th} area. [H_Z /pu.MW]

K_{pi} = 1/D

T_{pi} Gain of power system (generator load) of i^{th} area. [H_Z /pu.MW]

T_{pi} = $2H_i / D_i f_i$

H_i Inertia constant of i^{th} area . [MW-sec/MVA]

ΔP_{Gi} Incremental generator power output change of i^{th} area .[pu MW]

ΔP_{ti} Incremental turbine power output change of i^{th} area. [pu MW]

K_i Gain of controller of i^{th} area

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