Impact of Renewable Generating Unit on Load Frequency Control in Multi-Area Power System Network under Deregulated Environment

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Abstract: Modern power systems would like a lot of intelligence and adaptability to manage and regulate the generation load equity from consequent severe perturbation because of appearing of sustainable energy sources. This complication is changing into a lot of important these days as a result of increasing variety of micro-grids (MGs). MGs typically use renewable energies in electrical production those varies spontaneously. So, variation and unpredictability in power systems becomes the traditional controllers to be less competent to keep a proper load frequency control (LFC) achievement for a ample spectrum of managing condition. In this paper, a hybrid power system is established between renewable and non-renewable generating units. A multi-area LFC network with integration of wind system has been planned. So, alongside with fluctuation in load, renewable energy sources RESs have a prejudicious response on system frequency. In this research paper, Author has represented the impact of RESs like wind generation plant to traditional energy sources for the betterment of load frequency control in which PID controllers are used for LFC and Binary Moth Flame optimizer (BMFO) is used for optimisation of controller parameters.

Keywords: Wind Technology (WT), Load Frequency Control, Hybrid Power System.

1. INTRODUCTION

The main purpose of a power system is to get constant supply to the customers with better quality of power. The generated power demand must be equilibrium. There are two basic position in which controlled power can be achieved: reactive balance of power and real power. Every environment is interconnected governor area, the arrangement regularity as well as interconnected tie-line can be kept constant through AGC[1]. The feedback control specified to generator is to control the system as it affects the output electrical power. So that the planned electrical power can be delivered to the customers. With the help of AGC, tie-lines and power flow can be audited. By calculating the net change in power generation and the change in position of the generators within the area so that average of the ACE (Area Control Error) can be minimised at a low value. The controlled output of the AGC is generally known as ACE[1]. When the ACE is set to zero with the help of AGC then, both frequency and tie-line errors can easily be minimised to zero.

Objectives of the work is:

- Study of the system performance
- Controlling parameters of gravitational search algorithm (GSA)
- Exhibit advantages of GSA over DE (Differential Evolution), BFOA (Bacteria Foraging Optimization Algorithm), GA (Genetic Algorithm)
- To depict the merits of the improved controller structure and aim is to increase performance of power system.

Electrical energy is key source for every electrical equipment to run and there are harmful effects to generate required electrical power, such as emission of carbon dioxide. The demand of the renewable energy sources has become more popular and clean energy can be produced through wind, hydro, biomass, solar and geothermal, which has globally increased. With the help of the renewable energy sources, air pollution problems can be solved, due to the occasional output power produces the new challenges in power systems. The renewable energy sources have great impact on system operation that can't be unnoticed.

Smart grid network depends on technology for implementing the system architecture in which electrical components worked through IP network. Smart grid contains transmission, generation, distribution and end user. Every node connects with each other and communicate through optimizing the system performance with reducing the risks. In a smart grid network, smart meters and smooth technical purposes transfers the data of vigour feeding and burden parameters to dispatch centre[10]. This facts is initially use for load distribution to remove the backouts which caused by overloading of the system and thereafter it saves the cost happened due to damage equipment.

When there is an increment or decrement in load then system frequency will change according to the load, AGC provides a benefit to the electrical system that whenever there is a increment or decrement in generation units then it will send a control signal to the generator unit to balance the system from varying load. Maintaining the same balance all the time is not possible but AGC gives the best possible solutions so that it can be controlled during the emergency situations. The problems arising in AGC can be solved through control theory. The problems happened due to controlling structure and optimization[11].

5. SIMULINK MODEL

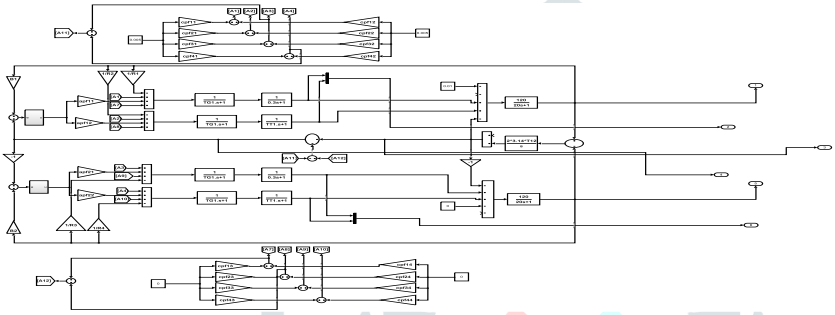
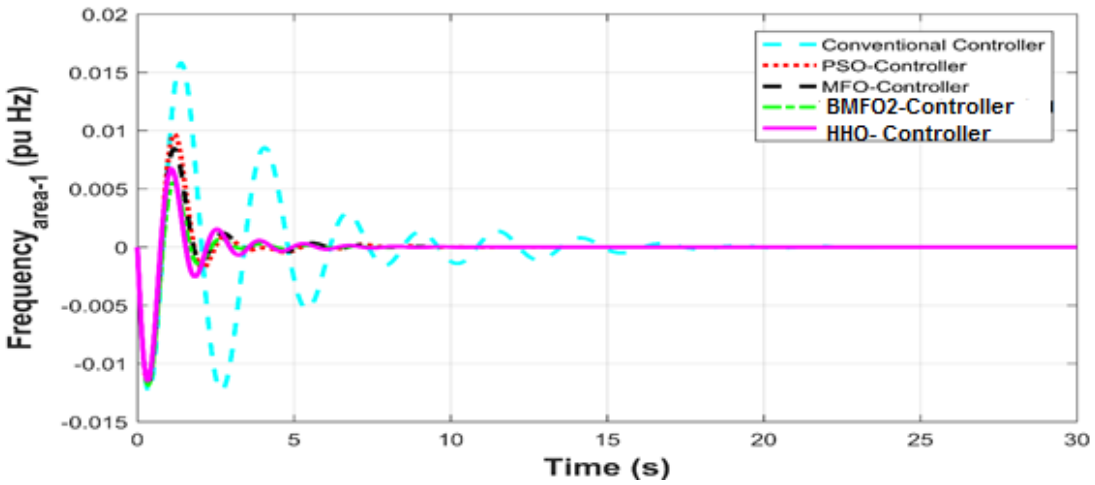


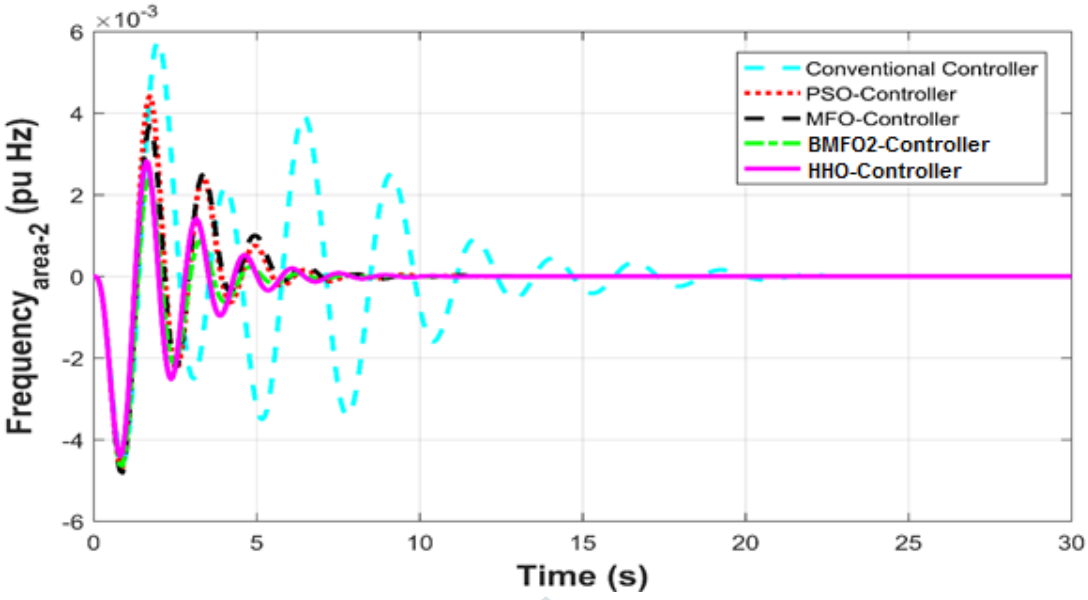
Fig. 1 Simulink Model of Multi area Hydro, Thermal and Wind Energy System

6. RESULT AND DISCUSSION

Reliable power system operation requires an ongoing balancing of supply and demand in accordance with established operating criteria.as results are shown in Fig.: 2- Fig.: 4. with respect to deviation in frequency and tie-line with the help of various controllers.

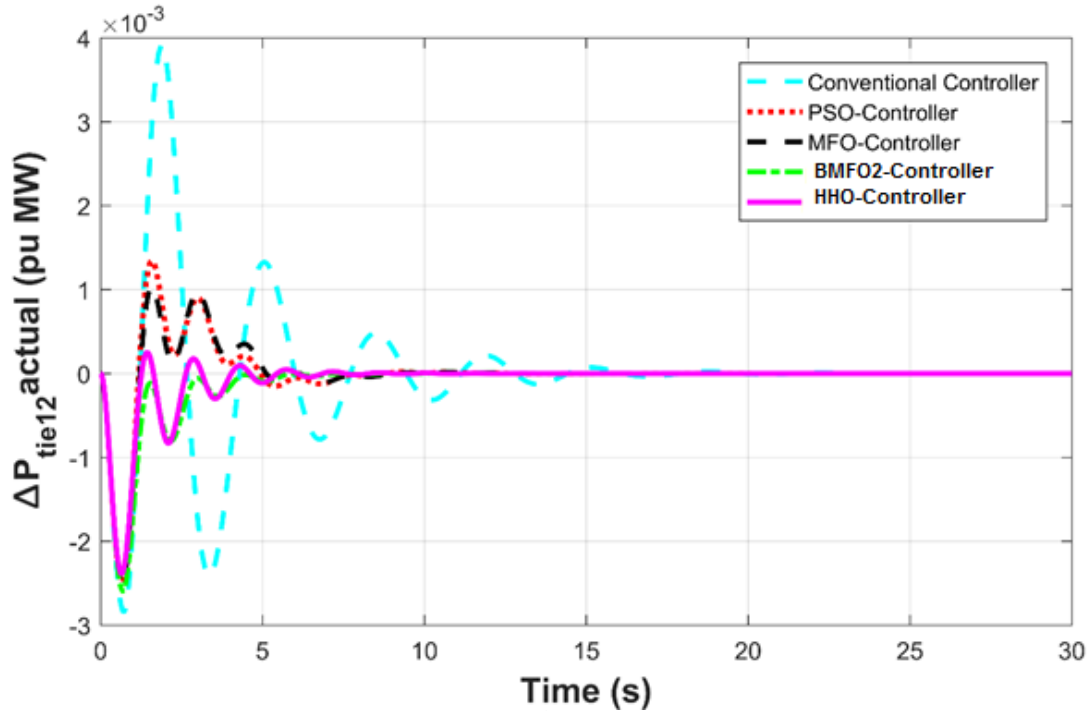


(a)

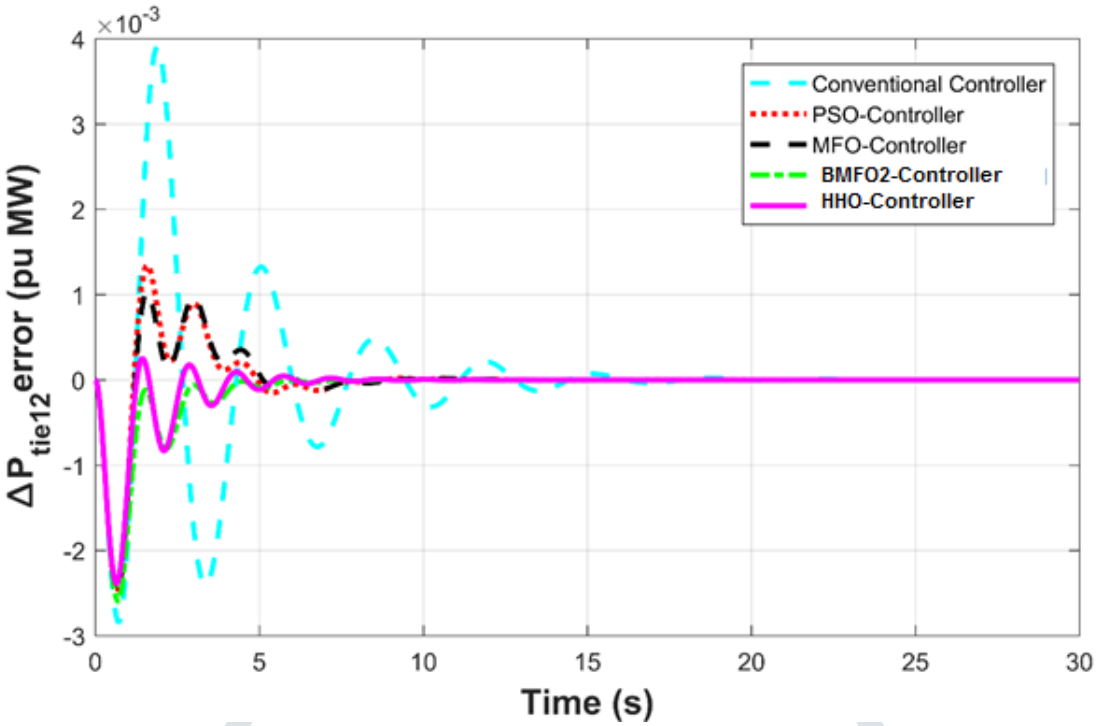


(b)

Fig. 2 (a)-(b): Deviation in Frequency for different Areas

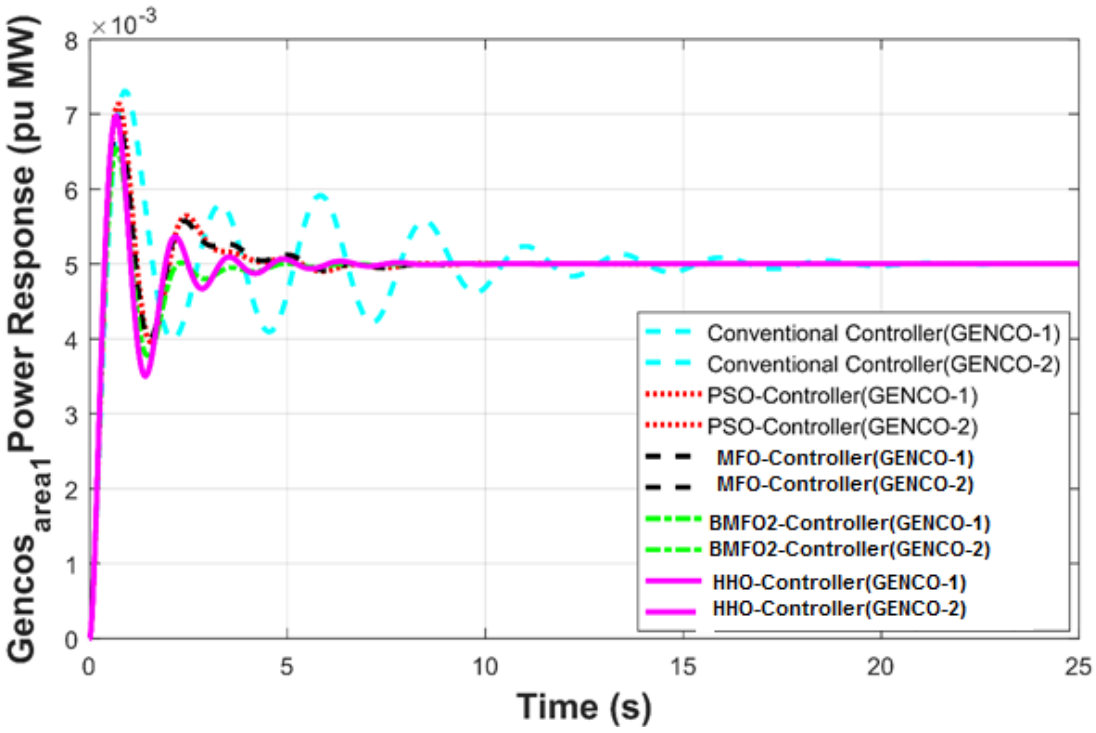


(a)



(b)

Fig. 3 (a)-(b): Deviation in tie-line power



(a)

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