

A Review on Load Frequency Control Strategy

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Abstract - The sustainable power sources have expanded essentially because of natural issues and petroleum derivatives raised expense. Incorporation of sustainable power sources to utility framework relies upon the size of intensity age. Enormous scale control ages are associated with transmission frameworks while little scale dispersed power age is associated with circulation frameworks. There are sure difficulties in the joining of the two kinds of frameworks legitimately. Because of this, wind vitality has picked up a ton of speculations from everywhere throughout the world. In any case, because of the breeze's speed unsure conduct it is hard to get great quality power, since wind speed changes think about the voltage and dynamic power yield of the electric machine associated with the breeze turbine. Sun based infiltration additionally changes the voltage profile and recurrence reaction of the framework and influences the transmission and dispersion frameworks of utility network. This paper exhibits a survey in the issues, challenges, causes, effects and usage of renewable energy sources (RES) - Grid Integration.

Key Words: Load Frequency Control, Renewable Energy Resources, Hybrid Power System, deviations in frequency.

1. INTRODUCTION

In the past decade oil crisis is more noticeable because of the economic dependency on the fossil fuels. Due to this significance the need of new sources for the energy is more necessary. The renewable energy source is the only solution for the problem like environment pollution which is the main reason for the global warming. Since they are everlasting one and have environment friendly nature due to these reasons the research on utilizing these energies are increasing now a days. But the technology has not yet reached its standard to be considered as a competitive for the fossil fuels. The energy analysis of solar energy and energy storage unit power is reviewed in this paper. The incorporation of renewable resource and distributed genset makes it the most suitable generating methodology for isolated communities. In isolated communities with low population densities, supplying electricity by spreading the transmission line from national power grid is expensive and some

localities are unbearable because of geographical difficulties. India will continue to familiarity an energy supply deficit throughout the forecast stage. This gap has broadened since 1985, when the country became a net importer of coal. India has been incapable to raise its oil production significantly in the 1990s. Mounting oil demand of close to 10 percent per year has steered to sizable oil import bills. In addition, the government subsidies sophisticated oil product prices, thus compounding the overall monetary loss to the government.

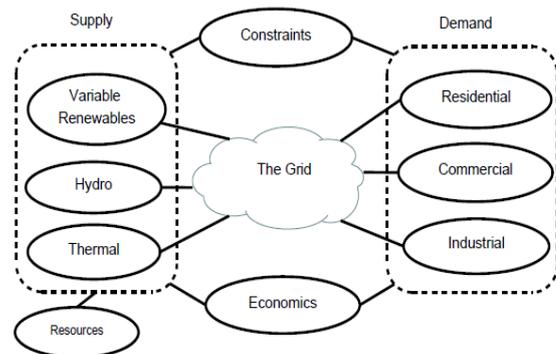


Fig 1 A schematic view of hybrid power system

There are two variables of interest, namely, frequency and tie-line power exchanges. Their variations are weighted together by a linear combination to a single variable called the ACE. The AGC issue has been increased with the significant research commitments every once in a while, as AGC controller plans in-collaborating parameter varieties/uncertainties, load characteristics, excitation control, and parallel air conditioning/dc transmission joins. The microchip based AGC controller, self-tuning controller, and versatile AGC controller plans have likewise been introduced. The latest progression here is the utilization of ideas like neural networks, fuzzy logic, and genetic algorithms to handle the difficulties related with the plan of AGC controllers for the power frameworks with nonlinear models as well as deficient learning about the framework required for its precise displaying. Aside from advances in charge ideas, there have been numerous progressions during the most recent decade or increasingly, for example, deregulation of power industry and utilization of SMES, wind

turbines, and PV cells as different wellsprings of electrical energy to the framework. Due to these, the control methods of reasoning related with AGC have changed to suit their elements and impacts on in general framework dynamic execution. The present investigation covers the basic survey of a wide scope of strategies of AGC controller plans of power frameworks with their striking highlights

2. LOAD FREQUENCY CONTROL

The small signal examination is supported for reading the system reaction for little irritations. Be that as it may, the execution of AGC procedure dependent on a linearized model on a basically nonlinear system does not really guarantee the steadiness of the system. Impressive consideration has been paid by specialists to think about the system nonlinearities. The destabilizing impact of sensor dead-band nonlinearity on customary the AGC system has been examined in writing. The principle targets of LFC for a power system are [1].

- Ensuring zero steady-state error for frequency deviations.
- Minimizing unscheduled tie line power flows between neighboring control areas.
- Getting good tracking for load demands and disturbances.
- Maintaining acceptable overshoot and settling time on the frequency and tie line power deviations.

Based on the above objectives, the two variable frequencies and the tie line power exchanges are weighted together by a linear combination to form a single variable called ACE, which is used as the control signal in the LFC problem.

3. CONTROL TECHNIQUES

The spearheading work by various control engineers, to be specific Bode, Nyquist, and Black, has set up connections between the frequency reaction of a control system and its shut circle transient execution in the time area. The examinations completed utilizing old style control methodologies uncover that it will bring about generally huge overshoots and transient frequency deviation. Besides, the settling time of the system frequency deviation is nearly long and is of the request for 10–20 s [2]. The AGC controller plan procedures utilizing present day

ideal control hypothesis empower the power specialists to structure an ideal control system regarding given execution model. A two-area interconnected power system comprising of two indistinguishable power plants of non-reheat turbines was considered for examinations. Another detailing for ideal AGC procedure has been seen. The possibility of an ideal AGC plan requires the accessibility of all state factors for criticism. Generally, LFC control design methodologies can be categorized as (i) classical methods, (ii) adaptive and variable structure methods, (iii) robust control approaches, (iv) intelligent techniques and (v) digital control schemes [2-4].

(i) Classical Methods: - Ordinary control procedures for the LFC issue are those that take the basic of the control blunder as the control signal. In the traditional control philosophies, to acquire the ideal increase and stage edges, Bode and Nyquist charts just as root locus are generally utilized. Hence, the plan methodology of the old style strategies for the LFC issue is straight forward, simple and agreeable for regular usage [5-6]. Notwithstanding, the examinations con-ducted utilizing these methodologies uncover that they show poor powerful execution, particularly within the sight of other destabilizing impacts, for example, parameter varieties and nonlinearities [7].

(ii) Adaptive Methods: - Adaptive control Adaptive control has been a subject of research for in excess of a fourth of a century. Essentially, adaptive control systems can be ordered into two classes: in particular self-tuning controllers and model reference control systems. The errand of the adaptive control system is to make the procedure leveled out less touchy to changes in plant parameters and to un-demonstrated plant elements. Different adaptive control techniques were proposed for LFC plans for managing plant parameter changes [8]. The control criteria in the LFC issue and the related down to earth difficulties experienced in attempting to accomplish these criteria. The usage and investigation of an adaptive LFC methodology on the Hungarian power system have been done [9]. An adaptive controller utilizing a corresponding indispensable adjustment to meet the hyperstability condition necessities considering plant parameter changes. A multi-area adaptive control methodology [10] for a LFC conspire and a decreased request adaptive burden frequency controller for interconnected aqueous power system have been

displayed in the writings. A self-tuning algorithm for arrangement of the LFC issue of interconnected power systems was re-reported to give the best control execution to a wide scope of working conditions.

(iii) **Intelligent Methods:** - Practically speaking, numerous nonlinear plants, for example, power systems, are approximated by decreased request models, potentially linear, that obviously are connected by the fundamental plant qualities. However, these models are just legitimate inside certain particular working extents, and an alternate model might be required in the wake of changing working conditions, or the control system ought to embrace the new system model parameters. Then again, because of the multifaceted nature and multi-variable states of the power system, old style and nonflexible LFC plans don't speak to sufficient arrangements. In this way, to assess the exhibition of such systems, an adaptable technique was created. As of late, the approach of current keen techniques, for example, ANNs, fuzzy logic and GAs, has tackled the previously mentioned issues all things considered. The human capacity to control complex plants has urged scientists to example controls on human neural network systems. ANNs, with their gigantic parallelism and capacity to become familiar with a nonlinearities, are presently being utilized in the area of nonlinear control issues, particularly when the system is working over the nonlinear range. They accepted the heap aggravations to be deterministic. They proposed a relative controller, dismissing the consistent state prerequisites and remuneration of burden aggravations. The primary confinement of the works introduced on AGC considering brought together control system is the need to trade data from control areas spread over indirectly associated geological regions alongside their expanded computational and storage complexities.

Of the two techniques portrayed, one was created utilizing a neural network algorithm for example acknowledgment of controllable sign, and the other method depended on the recognition of the controllable sign within the sight of an uproarious arbitrary burden utilizing an irregular sign likelihood model. Test outcomes uncover that the neural network-based AGC usage had a critical improvement over the cutting edge AGC execution. The LFC system execution was assessed with a nonlinear neural network controller utilizing a summed up neural structure to yield preferred

system dynamic execution over the individual neurons [11]. A four-area interconnected power system model with a warm nonlinearity impact of the steam turbine and upper and lower imperatives for age rate nonlinearity of the hydro turbine was considered for the examination in Ref. [12]. It has been appeared in Ref. [13] that the AGC issue can be seen as a stochastic multi-arrange basic leadership issue or a Markov Chain control issue, and algorithms have been displayed for planning AGC dependent on a support learning approach.

As of late, use of the ANN strategy dependent on strong control techniques for arrangement of the LFC issue in interconnected power system has showed up in the literary works [12-13]. Researcher have utilized the possibility of the H1 powerful control procedure for preparing of RBF neural networks for improve-ment of the exhibition of the proposed controller under different working conditions. The possibility of l-combination control techniques has been utilized for preparing an ANN-based LFC controller as well. These methodologies consolidated the benefit of neural networks and hearty control techniques to accomplish the ideal degree of powerful presentation under huge parametric uncertainty and lead to an adaptable controller with moderately straightforward structure.

These days, fuzzy logic is utilized in practically all segments of industry and science. One of them is power system control. Then again, their strength and unwavering quality make fuzzy controllers valuable for unraveling a wide scope of control issues in power systems. Un-like conventional control hypothesis, which is basically founded on mathematical models of the controlled plants, the fuzzy control procedure attempts to set up the controller legitimately from area specialists or administrators who are controlling the plant physically and effectively. To consider different power system viewpoints many studies have been accounted for plan of a fuzzy logic-based LFC regulator in the writing [14]. Looks into on the LFC issue demonstrate that the fuzzy PI controller is less complex and increasingly pertinent to expel the enduring blunder. The fuzzy PI controller is known to give horrible showing in system transient reaction. In perspective on this, [14] have proposed fuzzy PID strategies to improve the presentation of the LFC issue. It ought to be brought up that they require a three-dimensional guideline base. This issue makes

the plan procedure progressively troublesome. The issue of decomposition of multi-variable systems with the end goal of circulated fuzzy control configuration was proposed in Ref. [15]. This strategy has decreased the quantity of intuitive fuzzy relations among subsystems. The joined keen strategy utilizing ANN and fuzzy logic hypothesis has likewise been introduced to use the novel parts of the two structures to a single hybrid LFC system.

4. CONCLUSION

This paper has provided a review of challenges and opportunities on controlling techniques. An exertion has been made to extant acute and wide-ranging recover on this subject. Highlighting has been specified how to grab the power disputes in DG system. The main challenge for grid-connected system as well as the stand-alone system is the intermittent nature of renewable resources. By integrating these resources into an optimum combination, the impact of the variable nature of these resources can be partially resolved and the overall system becomes more reliable and economical to run. It has been observed in this literature survey that most of the researchers have done work on multi area power system problems confined to conventional power system. Further, it can be said that there exists a lot of research opportunities in load frequency control on issues related to hybrid system. Although PI controller is normally used in the past but intelligent controller shows better performance. This survey paper will serve as a valuable reference for researchers to work on hybrid power system for load frequency control.

ACKNOWLEDGEMENT

The work is financially supported by UIET, KUK, Haryana. I would like to thank my mentor Mr Vijay Kumar Garg for providing me such environment.

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