Design of an Adaptive Load Frequency Control for Two Area System

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ABSTRACT:
This paper deals with frequency control of two area coupled electrical system and few techniques are been proposed to suppress the aberrations in frequency and to keep tie-line power at an acceptable level. Three methods compared, among them the first one is based on traditional PI controller tuned through Ziegler–Nichols and the other is PI controller tuned by genetic algorithm and nominated one is fuzzy controller. Proposed method gives better dynamic response of the system which resulted considerably low response time and peak over shoot.

Key words: Load frequency control (LFC), Ziegler–Nichols approach, genetic algorithm, fuzzy controller, PI controller

I.INRODUCTION:

An electrical system is kinship of various control areas, which are associated among one another through tie lines. As frequency and tie-line power exchange, are highly dependent on active power of the system. So variation of active power makes the frequency and tie line power to depart from their anticipated values. As emanation, the achievement of the electrical system may deteriorate. The regional governor of electrical system can accommodate generator gain to moderate load change. But with this kind of action, as the load on system escalate, the system frequency gets decline and the reverse will happen if the load on system decline. Consequently an auxiliary controller is necessary for the electrical system to uphold frequency of system at its limits. So, the auxiliary control is called automatic generation control, or load frequency control (LFC).To maintain balance operation of electrical systems, consistent frequency and adequate tie-line power interchange must be managed. LFC is to manage the frequency of a electrical system closely around its nominal value when demand or supply oscillate.

From the past few decades, momentous evolution is made in this area. In initial phases LFC is integrated control that is mainly for transposition of knowledge from control areas transmitted over precisely coupled geographical boundaries. So as to beaten these obstacles, regionalized LFC is presently stand advanced, so that individual areas manage their control established on regionally accessible state variables.

Most of the controllers used in industries are PI which are carol online based on trial and error approach. But the trial and error approach is not an appropriate control strategy for present electrical system conditions so different optimization techniques has been suggested to model the regulated parameters.

This paper come up with different scattered LFC approach for an interdependent electrical system which are genetic algorithms and fuzzy logic controller

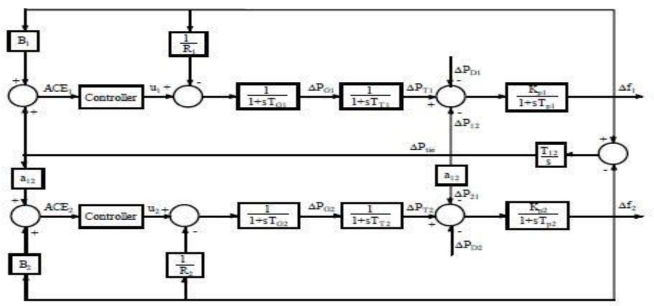

Fig: Interconnection of two area power system

II. ZIEGLER-NICHOLS (Z-N) TUNING TECHNIQUE:

Ziegler–Nichols attenuate technique is a classical technique to attenuate PI controllers. This technique was proposed by John Ziegler and Nathaniel B. Nichols.

- At the beginning stipulate proportional (Kp), integral gain (Ki) and derivative gain (Kd) values tozero.
- Generate slight distraction in hoop by modifying the fixed count. Regulate the proportional gain, in accreting and decline

aspect, until the system exhibits sustained pulsations with consistent magnitude.

- Now document the retrieved value as ultimate gain (Ku) and time taken for one complete pulsations as ultimate period of pulsations.
- Insert the obtained equivalents in the Ziegler- Nichols formula.

That is $K_p = 0.45 \times K_u$; $K_i = (1.2 \times K_p)/P_u$

III. GENETIC ALGORIHTMS:

Genetic Algorithms (GA's) are speculative overall search method that imitate the process of intuitive progression. Generally genetic algorithms initiate with no awareness of the accurate explication and build up totally on feedback from its surroundings operands (i.e. reproduction, crossover and mutation) so as to come up with best result.

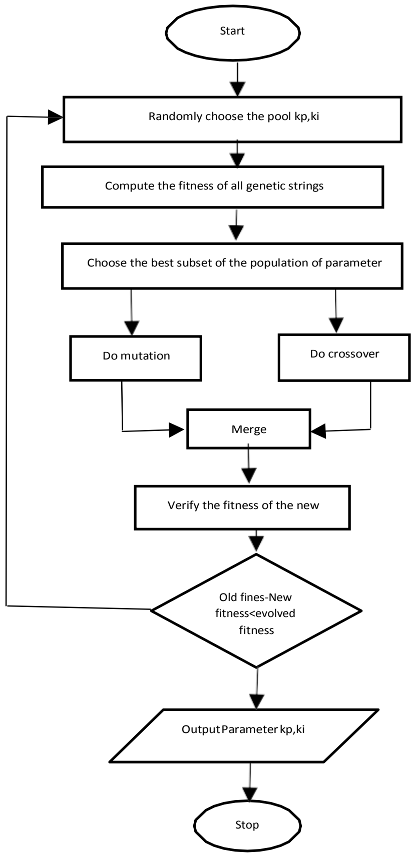

Fig: Genetic Algorithm for PI controller.

IV .Fuzzy Logic Controller:

Traditional Proportional plus Integral Controller (PI) offers zero steady state frequency deviation, but displays unfortunate dynamic enactment (more numerous oscillations & larger settling time), specifically in case of constraints dissimilarities and non-linearity.

If the system heftiness and accuracy are more key essences, Fuzzy Logic Controllers can be more useful in giving better solutions to a wide range of control difficulties as conventional controllers are sluggish and also less well-organized in nonlinear system solicitations.

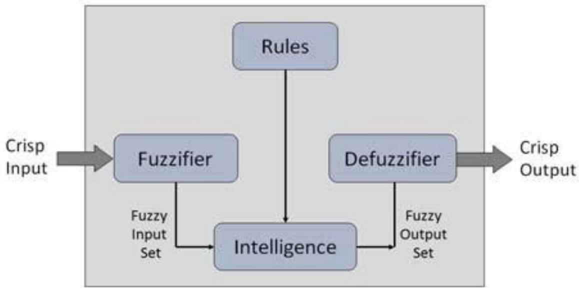

Fig: Structure of Fuzzy Controller

V.RESULTS:

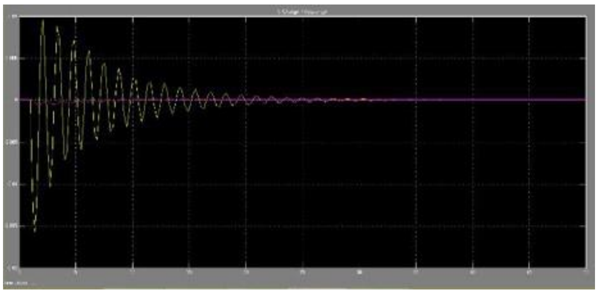

Fig1. Frequency error response of area-1 response for by Ziegler-Nichols tuned controller

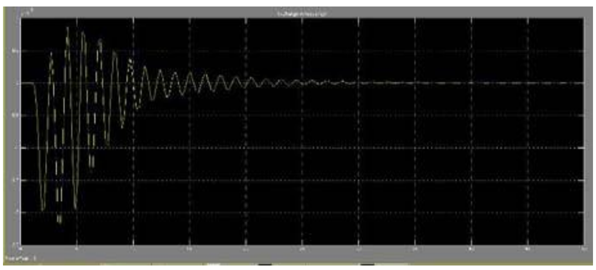

Fig2. Frequency error response of area-2 by Ziegler-Nichols tuned controller

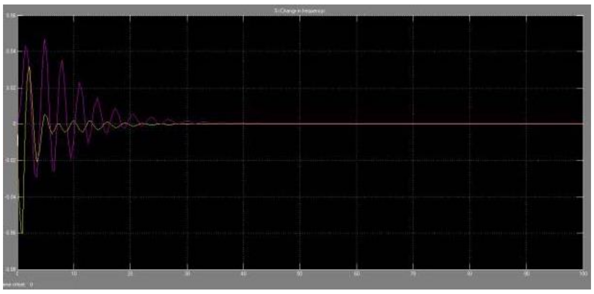

Fig3. Frequency error & tie-line power response of area-1 by genetic algorithm tuned controller

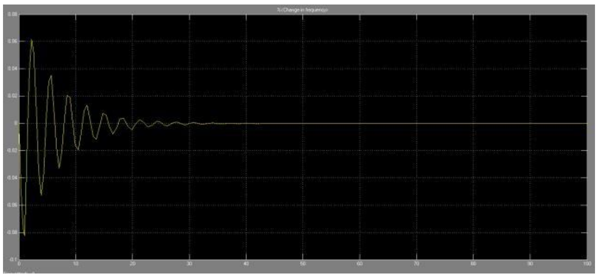

Fig4. Frequency error response of area-2 and for two-area system with genetic algorithm tuned PI controller.

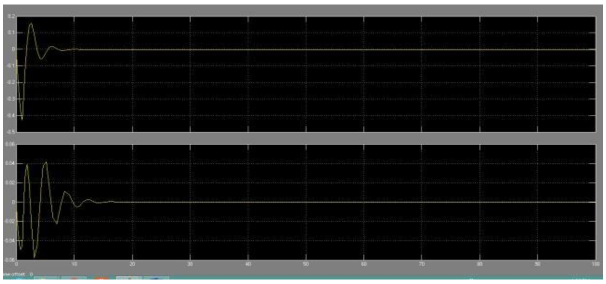

Fig5: Frequency error response in area-1 and tie-line response using fuzzy control.

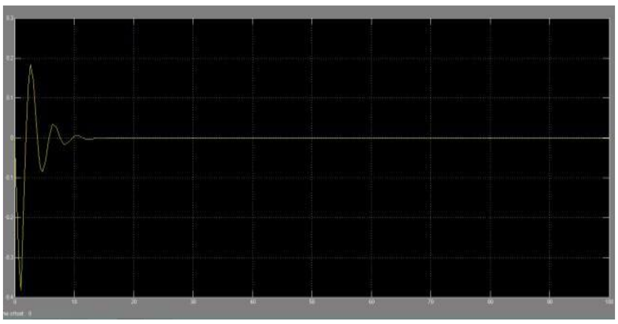

Fig6: Frequency error response in area-2 using fuzzy control.

Type of Tehnique	Settling Time(sec)		Overshoot/Undershoot(pu)	
	Area-1	Area-2	Area-1	Area-2
Ziegler-Nichols	18	24	0.01/-0.03	0.09/-0.085
Genetic Algorithm	12	17	0.03/-0.06	0.068/-0.09
Fuzzy Logic	6	11	0.2/-0.5	0.026/-0.48

Table2: Comparison of Conventional tuning method with GA and Fuzzy Controller

VI.CONCLUSION:

The frequency control of two area system was studied. Here the tuning of PI parameters are done by using different control techniques. Among the three control techniques, proposed one gives better response with fast settling time and with less overshoot/undershoot. Further these control parameters may be tuned with some more advanced optimization tools like hybrid optimization techniques.

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