USING FUZZY LOGIC CONTROLLER FOR MULTI AREA LOAD FREQUENCY CONTROL AND ANALYSIS

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Abstract: load frequency control (LFC) for multi-area power structures is developed primarily based at the direct–indirect adaptive fuzzy manage technique. LFCs for each vicinity are designed based on availability of frequency deviation of every area and tie-line power fluctuation between areas. The fuzzy common sense system control regulation and parameter replace algorithms for unknown interconnected LFC areas. A tracking performance criterion is brought to limit the approximation mistakes and the external stressful effects. As frequency variation problem become more prominent when it comes to deal with grid connection. So it is very much important to control and maintain frequency deviation within the limit as smoother as possible so to accomplish this task in a multi area system we will use fuzzy logic controllers to prevent deviation and to maintain system stability.

Introduction:

In latest days, electricity device has plenty more complex and non-linear configuration. Therefore, tie-strains are used for diverse interconnected areas. Energy change between regions and inter location support during abnormal condition are supplied via tie-lines [1-4] .These tie- lines were analysed with power flickering which results in increased system capability [1]. Thus, load frequency manage is more advanced controlled scheme which has been observed. In electrical electricity machine, load-frequency (LF) control plays an vital task for electricity system operation and design. Voltage and frequency controller are required to keep generated energy best as a way to supply regular voltage and frequency. Thus, the frequency is balanced or controlled by means of load-frequency controller. So many researches has been performed over previous couple of decades concerning load-frequency manipulate of single and multi area power device [1-12].Reliable and exceptional operation can be furnished through LFC in interconnected regions of energy system.

1.2 FREQUENCY LOAD CONTROL

Main function of load frequency is to make certain solid and reliable operation of power machine. The PI controller is very simple for implementation and gives better dynamic response but their dynamic performance go to pot whilst complexity in the system increases because of disturbances like load version boiler dynamic

problem. Fuzzy logic offers higher performance over traditional controller in particular in complex and non-linearity. However it's miles demonstrated true dynamics only when selecting the specific membership function. In this paper, overall performance evaluation based on PI controller, Fuzzy logic controller and synthetic neural controller for multi area manipulate device is proposed.

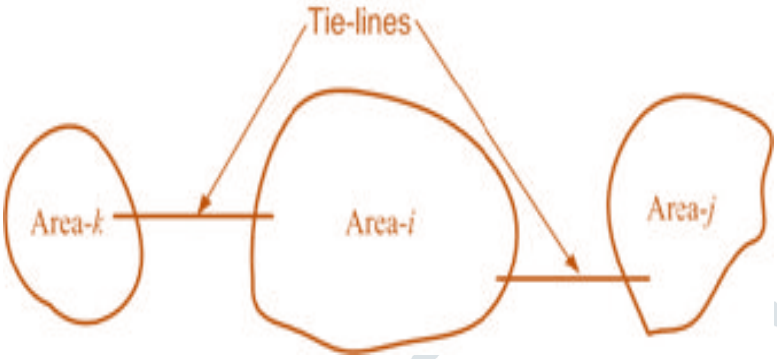

Fig 1: Interconnected areas in a power system

"Mamdani type"

Fuzzy inference gadget is used to locate profits at exclusive operating machine. Main targets of this paper are: -Proposed controller must gain LFC goals. The problem of controlling the strength output of the turbines of closely electric area so, as to hold the schedule frequency. All the generators in such vicinity represent a coherent organization so, that everyone the generators speed up and slow down together to maintain their relative electricity angles. Such place is described as control area.

Rajesh nayandeo and M. Venkteshlu [2], provided in their paper the control method of 4 vicinity power machine using the bushy good judgment controller and gave their comparative results displaying superiority of LFC over conventional PID controllers.Ehsan gholanpur provided in his paper the optimized kind-1 fuzzy logic controller became proposed to solve the weight frequency control hassle of unmarried place power machine. Using PSO algorithm the parameters of the membership characteristic of kind 1 fuzzy controller were optimized. Simulation results show that the proposed type-1 fuzzy controller in damping of frequency deviations of power machine has a better performance than the PI controller.

LOAD FREQUENCY CONTROL

Power machine operation so far was under circumstance of regular load. However, both active and reactive energy demands are in no way consistent and they always trade with the rising or falling demand. Steam input to turbo turbines ought to therefore, be continuously modify to match the energetic strength demand failing which the system speed will vary with consequent change in frequency which may be surprisingly undesirable. So, it's far necessary to major the system frequency to appropriate rate.

Control system Performance

Factor affecting control systems are:-

- Choice of controller.
- Tuning of controllers.
- Selection of control variables.
- Types of sensor.
- Disturbances/Environment.

The proportional, integral, and derivative terms are summed to calculate the output of the PID controller. Defining u(t) as the controller output, the final shape of the PID algorithm is:

$$u(t) = MV(t) = K_p\, e(t) + K_I \int_0^t e(\tau)d(\tau) + K_d \frac{d}{dt} e(t)$$

Where,
Kp: Proportional gain, a tuning parameter
Ki: Integral gain, a tuning parameter
Kd: Derivative gain, a tuning parameter
e*:** Error = ***SP-PV
***t*:** Time or instantaneous time (the present)

τ: Variable of integration; takes on values from time **0** to the present's ***t***.

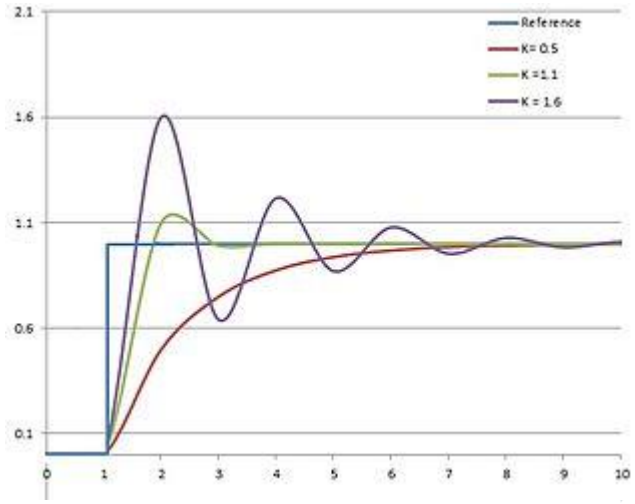

Fig 2: Plot of PV vs. time, for 3 values k_p (k_i and k_d held constant)

The proportional term produces an output value that is proportional to the current error value. The proportional response can be adjusted by multiplying the error by a constant K_p, called the proportional gain constant. The proportional term is given by:

$$P_{out} = K_p\, e(t)$$

SIMULATION ANALYSIS:

Each block within a semolina model has these general characteristic:

A set of input u

A set of output y

A set of states x

The state vector may consist of continuous state discrete state or a combination of both. The mathematic relationship between these quantities is expressed by these equations:

Y = fo (t, x, u) (output)

X (dk+l) =fu (t, x, u) (update)

Xc = fd (t, x, u) ...

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Simulation consists of two phases' initialization and simulation. Several actions take place during the initialization phase.

FUZZY LOGIC CONTROLLER

Fuzzy good judgment is used to format LFC. Generally, AFLC scheme is categorized as direct and indirect. In direct, fuzzy common sense machine is used to generate manage signal. And in indirect, fuzzy common sense gadget is used to approximate unknown functions. Direct-indirect fuzzy good judgment FLC is proposed where, fuzzy common sense gadget is employed for an every place due to unknown interconnections and unknown linearity due to GRC and GDB.

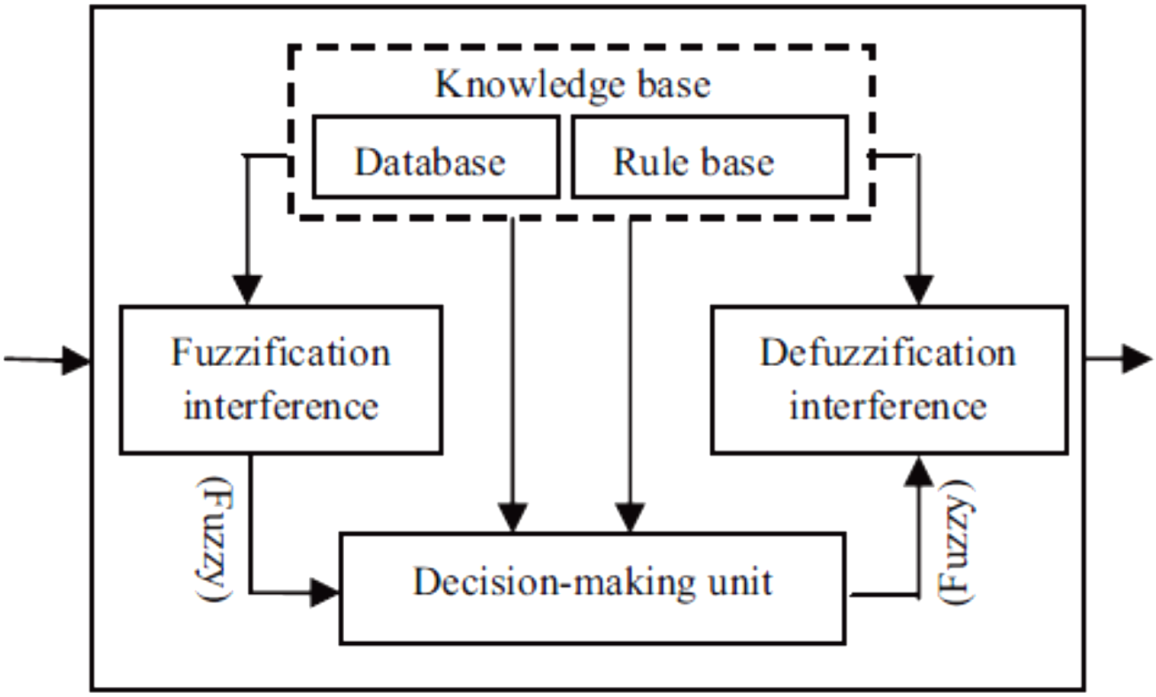

Fig.3 Diagram of fuzzy inference system.

A accepted mamdani kind fuzzy controller has been simulated for the LFC to damp out the oscillations due to on the spot perturbation as speedy as possible. The parameters that have an effect on the machine overall performance is viewed as the inputs and they are

1) The frequency error

2) The exchange of frequency error

Result

In this, we are the use of Matlab/Simulink programming in order to manipulate the frequency. The primary reason of the use of Fuzzy good judgment controller is that is very sturdy and reliable.

A	B	K	I
NB	NB	S	S
NS	NS	M	M
ZZ	ZZ	B	B
PS	PS	VB	VB
PB	PB	VVB	VVB

RULE TABLE

As show on above table in this we are using 25 rules. And triangular membership functions.

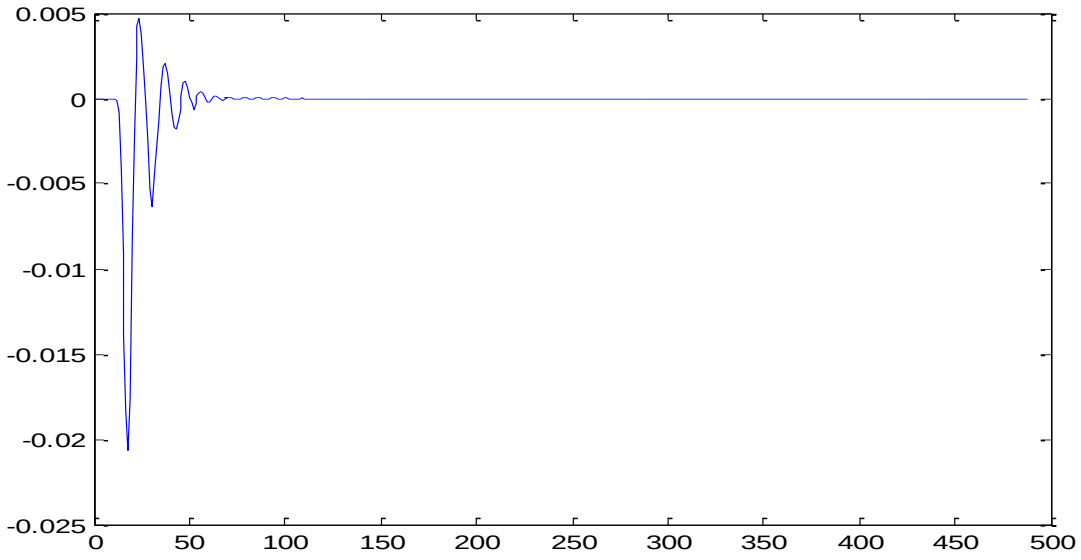

Fig 4: Frequency deviation with respect to time

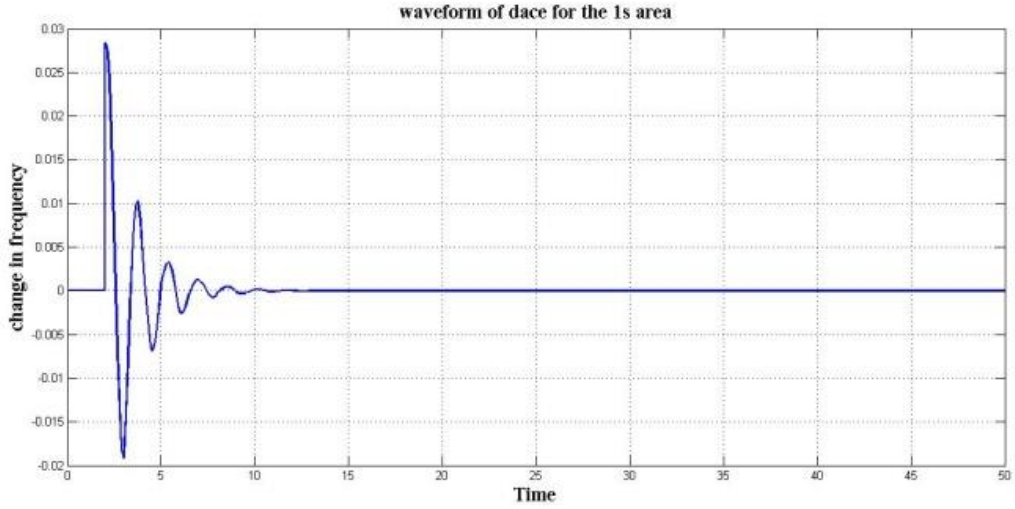

Fig.**5**. response of three location energy device for dace underneath state of affairs I

Conclusion:

Time taken by way of the fuzzy controller (LFC) to manage the frequency of the multi region device is very much less in contrast to different techniques. For the LFC problem, some of the plant limits such as technology price constraints and lifeless bands are neglected in this thesis. However, in reality, they exist in energy systems. In the future, we sketch to consist of the plant limits in the mannequin of the strength device to make the mannequin extra practical.

REFRENCES:-

[1] H. Bevrani and T. Hiyama, Intelligent Automatic Generation Control. Boca Raton, FL, USA: CRC press, 2011.

[2] C. Zhang, L. Jiang, Q. H. Wu, Y. He, and M.Wu, "Delay-dependent robust load frequency control for time delay power systems," IEEE Trans. Power Syst., vol. 28, no. 3, pp. 2192–2201, Aug. 2013

[3] Y.H. Song and A.T. Johns, "Applications of fuzzy logic in power systems: part 1 general introduction to fuzzy logic,Power Engineering Journal, pp. 219-222, 1997

[4] Roohi Kansal1, Balwinder Singh Surjan "Study of Load Frequency Control in an Interconnected System Using Conventional and Fuzzy Logic Controller"

[5]J.TalaqandF.AlBasri,"Adaptivefuzzygainschedulingforloadfrequencycontrol,"IEEETrans.PowerSyst.,vol.14,no.1,pp.145–150, Feb. 1999

[6] K.R. Padiyar, 2002, "Power System Dynamic Stability and Control," Second Edition, BS Publications, Hyderabad.

[7] I. Kocaarslan and E. Cam, "Fuzzy logic controller in interconnected electrical power systems for load-frequency control," Electr. Power Energy Syst., vol. 27, pp. 542–549, 2005

[8] C.-F. Juang and C.-F. Lu, "Load-frequency control by hybrid evolutionaryfuzzyPIcontroller,"Proc.Inst.Electr.Eng.—Gener.,Transm. Distrib., vol. 153, no. 2, pp. 196–204, 2006

[9] I.H. Altas and A.M. Sharaf, "A Generalized direct approach for designing fuzzy logic controllers in Matlab/Simulink GUI environment," International Journal of Information Technology and Intelligent Computing, Int. J. IT&IC, vol.1, no.4, 2007.

[10] Y.H. Song and A.T. Johns, "Applications of fuzzy logic in power systems: part 3 example applications," Power Engineering Journal, pp. 97-103, 1999.