

INTELLIGENT TECHNIQUES FOR ENHANCEMENT OF SMALL SIGNAL ROTOR ANGLE STABILTY

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CERTIFICATE

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ABSTRACT

The utilisation of power system stabilizers (PSS) has developed gigantically customary in living up to expectations of huge electric power systems. Nonetheless, it was difficult to create a stabilizer that would exist with capability to perform in every single working purpose of electric power systems. With a soal aim to cover all the possible range of working conditions, Fuzzy logic has been prescribed the conceivable response to control this complication, by use of linguistic data and evading a complex structure mathematical model.

In this theme, a step wise resemble to fuzzy logic and PID controller object is suggested. This theme presents a comparative study of, without use of PSS and conventional PSS along with the use of Fuzzy and PID control techniques for solidness heightening of a single machine infinite bus system. With a soul objective to get the stability heightening, precise speed deviation $\Delta\omega$ and acceleration $\Delta\dot{\omega}$ of the rotor synchronous generator taken as inputs to fuzzy logic controller while only speed deviation $\Delta\omega$ has been used as input for PID control and conventional PSS. These variables have given significant outcome on damping out the mechanical oscillations created by generator shaft. Relying on these inconstants the stabilized signals were find out using the function of fuzzy membership and also by using PID controller. The values of K_p , K_i , K_d are found out using trial and error method. The fuzzy controller used has been compared with different overlapping of the membership function. Simulink has been used in matlab-10 for block designing of above.

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LIST OF ABBREVIATION

SMIB: SINGLE MACHINE INFINITE BUS SYSTEM

PSS: POWER SYSTEM STABILIZER

PID: PROPORTIONAL-INTEGRAL-DERIVATIVE

FLPSS: FUZZY LOGIC POWER SYSTEM STABILIZER

AVR: AUTOMATIC VOLTAGE REGULATOR

CPSS: CONVENTIONAL POWER SYSTEM STABILIZER

FLC: FUZZY LOGIC CONTROLLER

GA: GENETIC ALGORITHM

ANN: ARTIFICIAL NEURAL NETWORK

ANFIS: ADAPTIVE NEURO FUZZY INFERENCE SYSTEM

BFO: BACTERIAL FORAGING ALGORITHM

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LIST OF SYMBOLS

SYMBOL	QAUNTITY
δ	Rotor angle
ω_r	Rated Speed (in electrical rad/s) $2\pi f$
$\Delta\delta$	Rotor Angle Deviation
$\Delta\omega_r$	Speed Deviation (in p.u.) $= \left(\frac{\omega_r - \omega_o}{\omega_o} \right)$
$\Delta\omega$	Speed deviation (Input to fuzzy logic Controller)
$\Delta\dot{\omega}$	Deviation in angular acceleration
ω_n	Undamped Natural Frequency (in rad/s)
ΔT_m	Deviation in Mechanical Torque
ξ	Damping Ratio
Ψ_{fd}	Field Circuit Flux Linkage
Ψ_d, Ψ_q	d-axis and q-axis Flux Linkage
L'_{ads}, L'_{aqs}	Saturated values of Transient Inductances
Ψ_{ad}, Ψ_{aq}	Air Gap Flux Linkage
A_{SAT}, B_{SAT}	Constants defining Saturation Characteristics of Machine
E_B	Infinite Bus Voltage (in p.u)
E_t	Generator Terminal Voltage
e_d, e_q	d-axis and q-axis component of E_t
E_{fd}	Exciter Output Voltage
H	Inertial Constant (in MW-s/MVA)
I	Line Current (in p.u.)
I_d, I_q	d-axis and q-axis components of line current
I_{fd}	Field Current
J	Combined Moment of Inertia of generator and turbine (in Kg-m^2)
$K_1, K_2, K_3, K_4, K_5, K_6$	K-Constants of Phillips Heffron Model
K_A	Exciter Gain
K_D	Damping Torque Coefficient (in p.u torque/ p.u speed deviation)
K_S	Synchronizing Torque Coefficient (in p.u. torque/rad.)
$K_{sd(incr)}, K_{sq(incr)}$	Incremental Saturation Factor

K_{stab}	Stabilizer Gain
L_l	Leakage Inductance
L_{fd}	Field Winding Inductance
L_{ad}, L_{aq}	d-axis and q-axis Mutual Inductance
L_{ads}, L_{aqs}	Saturated values of d-axis and q-axis Mutual Inductance
P	Active Power (in p.u.)
P_e	Air Gap Power (in p.u.)
Q	Reactive Power (in p.u.)
R_a	Armature Resistance per Phase (in p.u.)
R_E	Transmission Line Resistance (in p.u.)
R_{fd}	Field Circuit Resistance
R_T	Total Resistance (in p.u.)
s	Laplace Operator
T_1, T_2	Phase Compensation Time Constant
T_3	Time Constant of Field Circuit
T_a	Accelerating torque (in N-m)
T_e	Electromagnetic Torque (in N-m)
T_m	Mechanical Torque (in N-m)
T_W	Time Constant of Wash out block
X'_d	Transient Reactance of Generator
X_E	Transmission Line Reactance (in p.u.)
X_T	Total Reactance (in p.u.)

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