STABILITY OF POWER SYSTEM USING ROBUST CONTROL

by

Eng. Ibrahim Youssef Ibrahim Saleh

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE

in

ELECTRICAL POWER AND MACHINES ENGINEERING

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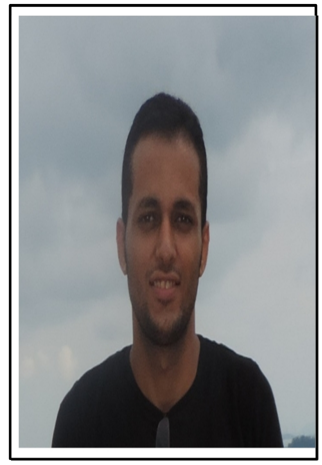
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Title of Thesis:

STABILITY OF POWER SYSTEM USING ROBUST CONTROL

Key Words:

Conventional Power System Stabilizer (CPSS), Fuzzy Logic Control (FLC), Robust control (H_∞ $controller$), Optimum Linear Regulator (OLR), Single Machine Infinite Bus (SMIB).

Summary:

In this thesis, the steam turbine SMIB is analyzed by using Heffron Phillip's model without and with taking into consideration steam turbine and Governor response. The stability of steam turbine SMIB with unstable or lightly damped rotor mode is improved by using the H∞ feedback controller. The effect of H∞ feedback controller is compared with the effect of CPSS, FLC, and OLR on power system stability under suddenly change in rotor speed of the system. The best performance for the system adjusts by the H∞ controller, and the system becomes more stable with any external or internal disturbance.

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LIST OF SYMBOLS AND ABREVIATIONS

d	The disturbance
D	Damping
ΔE_{fd}	Deviation of field voltage
$\Delta E_q{}'$	Deviation of internal quadrature voltage
F_{HP}	Fraction of high pressure stage
F_{IP}	Fraction of intermediate pressure stage
F_{LP}	Fraction of low pressure stage
H	Per unit inertia constant
I_{do}	Direct axis current
I_{qo}	Quadrature axis current
$K_1 \vdots K_6$	Heffron – Phillips constants
K_A	Amplifier gain
K_{stab}	The stabilizer gain
K_{U1}	Multiplied gain for error of fuzzy logic control
K_{U2}	Multiplied gain for error change of fuzzy logic control
K_{U3}	Multiplied gain for output of fuzzy logic control
M	Moment of inertia
P	Pressure of steam in turbine
P_0	Rated pressure
P_e	Electrical power
P_m	Mechanical power
P_s	Synchronization power
Q	Steam mass flow rate
Q_L	Reactive power for load
Q_0	Rated flow out of turbine
Q_{out}	Output steam mass flow rate
R	Transient droop or regulation