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NISHA KAMBOJ

08/PS/2010

CERTIFICATE

This is to certify that **NISHA KAMBOJ (08/PS/2010)** has carried out her major project work in partial fulfillment for the degree of **MASTER OF TECHNOLOGY IN POWER SYSTEM** on the topic **"COMPARITIVE STUDY OF DAMPING SUBSYNCHRONOUS RESONANCE USING SSSC AND STATCOM "** during the period under my supervision and guidance and has completed the project to my satisfaction.

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ABSTRACT

Application of series capacitor in long transmission line is a cost effective method to increase power transfer. But presence of series capacitor has sometimes been limited because of the concern for subsynchronous resonance phenomenon in transmission line. SSR is basically an electrical power system condition where the electrical network exchanges energy with the turbine generator at one or more of the natural frequencies of the combined system below the synchronous frequency of the system. Presence of SSR torque causes oscillation which introduces shaft fatigue and possible damage or failure of shaft. Long transmission line needs series or shunt compensation for power flow control as well as for mitigating the SSR phenomenon.

An idea of this thesis is to damp SSR by adding static synchronous series compensator (SSSC, Series device) or Static compensator (STATCOM, Shunt device). This thesis shows that damping characteristics obtained by SSSC is better than STATCOM for damping SSR phenomenon. The results are obtained by modelling a lineralized system in MATLAB and study is performed on the system adapted from the IEEE first bench mark model for Eigenvalue analysis for SSR study.

SSSC is a series FACTS device, which could be used to completely replace traditional series capacitor with even more flexibility of series compensation. By including STATCOM in series compensated transmission line which do not change the SSR characteristics of network significantly. This thesis provides comparative study of damping SSR by using FACTS Devices SSSC and STATCOM which is series and shunt device respectively. It is found that SSSC a series FACTS device is more effective in damping SSR in comparison with STATCOM which is a shunt FACTS device.

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

C	Capacitor
v_a,v_b, v_c	Stator three-phase voltages, respectively
E_{fd}	Field voltage
EXC	Exciter
F	Frequency
GEN	Generator
HP	High pressure turbine
i_a, i_b, i_c	Stator currents in phase a, b, and c, respectively
IP	Intermediate pressure turbine
L	Inductor
LPA	Low pressure turbine A
LPB	Low pressure turbine B
P	Active power
p.u.	Per unit
Pe	Electrical power
Q	Reactive power
R	Resistor
RMS	Root mean square value
T_e	Air gap torque
Ψ_d , Ψ_q	Stator flux linkages in d-q components
δ_{GEN}	Generator power angle
X_C	Capacitive reactance
X_L	Inductive reactance
Δ	Prefix to denote a small deviation in the initial operating point

A	State matrix
B	Control or input matrix
C	Output matrix
DEXC, DGEN, DLPB, DLPA, DIP, DHP , DIM	Damping coefficient of the corresponding inertia
SEXC, SGEN, SLPB, SLPA, SIP, SHP , SIM	Slip of the corresponding inertia
IMDU	Induction machine damping unit
TGE, TLBG, TLAB, TILA, THI, TPI	Input torques to the respective Shaft section
O	suffix to denote the initial operating operation
ω_B	Natural frequency of system

INDEX