DESIGNING AUTOMATIC LOAD-FREQUENCY CONTROL SCHEME FOR SRI LANKAN POWER SYSTEM

Ganeshan Kishokumar

(159311X)

Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa
Sri Lanka

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Declaration

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters under my supervision.

Signature of the supervisor: Date:
(Dr. Asanka Rodrigo)

Abstract

The Sri Lankan power grid is being operated at nominal frequency which is 50 Hz and steady state regulation window is 49.50 Hz to 50.50 Hz. There will be a frequency error left behind, during either demand or generation change as per system dynamics. Such error is generally corrected by secondary control regulation which is mainly done by verbal dispatch instruction originated from system control center. Hence, the regulation quality of grid frequency is highly depended on above said manual frequency corrective action which is executed by the Control Room Operator(CRO) back in the related power plants. The amount of frequency deviations within the operational limit, have been increased significantly during the last couple of years in Sri Lankan system.

The aim of this study is to design and analyse the Automatic Load Frequency Control(ALFC) scheme for regulating secondary control spinning reserves based on persisting Area Control Error(ACE) values. Hence, MATLAB Simulink models are developed for primary and secondary regulations while addressing the unique constraints related to frequency regulation of Sri Lankan power system. Consequently, both the models are combined and the behavior of system frequency response with ALFC is studied in detail for different generation scenarios.

The outcomes direct that, how exactly ALFC could be implemented in Sri Lankan power system while exhibit the enhancement of frequency regulation quality. The designed model and obtained results during this study could be used as base-case platform for implementation or further study of ALFC methodology for Sri Lankan power system.

Key Word: Frequency Control, Automatic Load Frequency Control, Power System Model.

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G. Kishokumar

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LIST OF ABBREVIATIONS

Abbreviation	Description
AGC	Automatic Generation Control
ALFC	Automatic Load-Frequency Control
CCP	Combined Cycle Power
CEB	Ceylon Electricity Board
CRO	Control Room Operator
DFR	Digital Fault Recorder
ED	Economic Dispatch
GE	General Electric
GIV	Gas Inlet Valve
GSS	Grid Sub Station
GT	Gas Turbine
KCCP	Kelanitissa Combined Cycle Power
KPS	Kelanitissa Power Station
LFC	Load-Frequency Control
LTI	Linear-Time Invariant
LVPS	Lakvijaya Power Station
MSIV	Main Steam Inlet Valve
MVA	Megavolt Ampere
OPF	Optimum Power Flow
PF	Participation Factor
PS	Power Station
PSS/E	Power System Simulator for Engineers
PU	Per Unit
RF	Regulation Factor
ROCOF	Rate of Change of Frequency
SCC	System Control Centre
WCP	West Cost Power