REACTIVE POWER DISPATCH BY DISTRIBUTED GENERATORS THROUGH STEP LOAD FLOW SIMULATION AND GENETIC ALGORITHM

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Degree of Master of Science

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Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science in Electrical Engineering

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(Prof. J.R. Lucas)

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Signature of the supervisor Date
(Dr. H.M. Wijekoon)

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A.M.G.G.S.H.B.Abeysinghe

ABSTRACT

Demand for reactive power in a transmission and distribution network is met by various ways such as through power generating plants, compensation by means of capacitors at the utility grid and compensation at the load point through capacitors etc. In CEB utility grid, most of the reactive power requirement is supplied by the grid via transmission and distribution network from major generating stations. This leads to increase of transmission and distribution network current, thereby increasing real power loss in the system

This can be avoided by producing required amount of reactive power closer to the load centers. Possibly, economical reactive power generation can be done at medium voltage systems. Medium voltage system consist of many distributed generators such as diesel generators, wind power generators, bio mass plants and mini hydro plants etc. Due to inconsistency of water inflow in Mini Hydro plants, they do not run at full load throughout the day. Thereby, Mini Hydro plants can be utilized to compensate reactive power requirement in the medium voltage level while meeting their primary objective of generating real power.

Generating reactive power from several mini hydro plants, while reducing losses at the power system is a complex optimization task. In this research Genetic Algorithm was used to solve above optimization problem and simulated in SynerGEE and Matlab software.

Results of this research is focused on developing a scheme to dispatch reactive power to the grid through Mini Hydro plants while reducing losses at the distribution system and meeting its primary objective of providing real power from the same Mini Hydro plants.

Key words Genetic Algorithm, Mini Hydro plants, Medium voltage

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LIST OF ABBREVIATIONS

ACSR	Aluminum Conductor Steel Reinforced
AR	Auto Recloser
BSC	Breaker Switched Capacitor
CEB	Ceylon Electricity Board
CRO	Control Room Operator
DNO	Distribution Network Operator
DCC	Distribution Control Centers
DG	Distributed Generators
GSS	Grid Substation
GA	Genetic Algorithm
HV	High Voltage
kVA	kilovolt Ampere
kW	kilo Watt
kWh	kilo Watt hour
MV	Medium Voltage
MVA	Megavolt Ampere
MW	Mega Watt
MWh	Mega Watt hour
MHP	Mini Hydro Plant
OPF	Optimum Power Flow
OLTC	On Load Tap Changer
PUCSL	Public Utilities Company Sri Lanka
PSS	Primary Substation
SPP	Small Power Producer
SVC	Static Var Controller
SCADA	Supervisory Control and Data Acquisition