thesis

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Multi Objective Economic Dispatch Problem of Micro Grid with Integrated Vehicle to Grid

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CERTIFICATE

We accept the work contained in this report as a confirmation to the required standard for the partial fulfilment of the degree of MS (EE).

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DEDICATION

I, Rizwan Hanif dedicated this thesis to my parents, professor and friends who support, motivate and encourage me throughout the project, without them it would not possible.

DECLARATION OF AUTHORSHIP

I **Rizwan Hanif Reg. # 01-244152-027** hereby declare that content of this thesis is my own work and that it is the result of work done during the period of registration. To the best of my knowledge, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

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Rizwan Hanif

ABSTRACT

The Power Economic Dispatch (PED) is the most important factor for the efficient operation and control of the power system. The PED is a problem related to the proper allocation of the available electrical power generating sources in order to meet the power demand at a minimized cost. Different conventional techniques are used to solve the PED problem by considering it as a conventional problem. The different conventional techniques used are Particle Linear Programming (LP), Lambda Iteration Method (LIM) and Dynamic Programming (DP) etc. The conventional techniques are not efficient enough to solve the complex PED problems. Different Artificial Intelligence (DAI) algorithms like particle Swarm Optimization (PSO), Artificial Neural Networks (ANN) and Fuzzy Logic etc. are also used to solve the non-convex PED problems.

The complexity of the PED is also increased with the increased number of sources available for power generation in the power system. The addition of the Electric Vehicles (EVs) also increases the complexity of PED problem. Most of the optimization techniques used for PED does not consider the emission constraints of the available sources while solving the PED problem. The Multi Objective Economic Dispatch Problem (MOEDP) of a Micro-Grid (MG) is established in the proposed research in which the emission constraints of the power generating sources are also considered. The power generating sources included in the proposed MG are the Wind Turbines (WTs), Photovoltaic Cells (PVs), Diesel Engine (DE), Battery Storage (BS), Fuel Cells (FCs) and EVs. The micro-grid is connected to the main grid by the distribution lines and allowed bi-directional flow of power i.e. from main grid to MG and from MG to the main grid. The Artificial Algae Algorithm (AAA) using MATLAB is used to solve the PED problem in the proposed research and the results are compared with the other optimization techniques. The comparative analysis shows that the results of AAA are better in terms of economics, emissions and convergence rate.

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ABBREVIATIONS

AAA	Artificial Algae Algorithm
ASO	Ant Swarm Optimization
BS	Battery Storage
CG	Centralized Generation
CQGA	Chaotic Quantum Genetic Algorithm
CSA	Cuckoo Search Algorithm
DAI	Different Artificial Intelligence
DC	Depreciation Cost
DE	Diesel Engine
DG	Distributed Generation
DM	Daily Mileage
DP	Dynamic Programming
ED	Economic Dispatch
ESS	Energy Storage System
EV	Electric vehicle
FC	Fuel Cell
GA	Genetic Algorithm
HSA	Harmony Search Algorithm
HOMER	Hybrid Optimization Model for Electric Renewable
IAGA	Improved Adaptive Genetic Algorithm
IICA	Improved Imperialist Competitive Algorithm
INIGA	Isolation Niche Immune Genetic Algorithm
IPSO	Improved Particle Swarm Optimization

K.E	Kinetic Energy
LIM	Lambda Iteration Method
LP	Linear Programming
MG	Micro Grid
MOEDP	Multi Objective Economic Dispatch Problem
MPEI	Multiport Power Electronic Interface
MPPT	Maximum Power Point Tracking
NSGA	Non-Dominated Sorting Genetic Algorithm
O&M	Operation and Management
PED	Power Economic Dispatch
PDF	Probability Density Function
PPF	Price Penalty Factor
PSO	Particle Swarm Optimization
PV	Photovoltaic
RES	Renewable Energy Sources
SOC	State of Charge
SPEA	Strength Pareto Evolutionary Algorithm
TCS	Thermo Chemical Storage
VESS	Virtual Energy Storage System
V2G	Vehicle to Grid
WT	Wind Turbine