

# Table of Contents

<b>Certificate</b>	<b>v</b>
<b>Declaration by Candidate</b>	<b>vii</b>
<b>Copyright Transfer Certificate</b>	<b>ix</b>
<b>Acknowledgement</b>	<b>xi</b>
<b>Table of Contents</b>	<b>xiii</b>
<b>List of Figures</b>	<b>xvii</b>
<b>List of Tables</b>	<b>xxi</b>
<b>Nomenclature</b>	<b>xxiii</b>
<b>Preface</b>	<b>xxxix</b>
<b>1 Introduction</b>	<b>1</b>
1.1 The Background . . . . .	1
1.2 Distributed Generation . . . . .	2
1.3 Literature Review . . . . .	4
1.3.1 Analytical Methods of DGs Placement . . . . .	6
1.3.2 Numerical Methods of DGs Placement . . . . .	7

1.3.3	Heuristic/Metaheuristic Optimization Methods for DG Placement and Network Reconfiguration . . . . .	9
1.4	Motivation . . . . .	17
1.5	Research objectives . . . . .	19
1.6	Thesis outline . . . . .	19
<b>2</b>	<b>Optimal Sizing and Siting of Multiple Dispersed Generation System Using PSO-GWO Algorithm</b>	<b>21</b>
2.1	Introduction . . . . .	21
2.2	Problem Formulation . . . . .	22
2.2.1	Active Power Loss . . . . .	22
2.2.2	Voltage Deviation . . . . .	23
2.2.3	Voltage Stability Index . . . . .	23
2.2.4	Proposed Multi-Objective Function . . . . .	25
2.2.5	System Constraints . . . . .	25
2.3	Proposed Approach of DG Placement . . . . .	26
2.3.1	Particle Swarm Optimization (PSO) . . . . .	27
2.3.2	Grey Wolf Optimization (GWO) . . . . .	28
2.3.3	Proposed Hybrid PSO-GWO-based Approach . . . . .	32
2.4	Results and Discussion . . . . .	34
2.5	Summary . . . . .	36
<b>3</b>	<b>Optimal Integration of Classified Dispersed Generation Units using Hybrid PSO-GSA Algorithm</b>	<b>39</b>
3.1	Introduction . . . . .	39
3.2	Problem Formulation . . . . .	40
3.3	Proposed Approach for Placement of Different Types of DGs along with Their Combinations . . . . .	41
3.3.1	Gravitational Search Algorithm (GSA) . . . . .	41

3.3.2	Proposed Optimal Placement of DGs using Hybrid PSO-GSA Algorithm . . . . .	44
3.4	Results and Discussion . . . . .	45
3.4.1	33-bus IEEE Network . . . . .	47
3.4.2	69-bus IEEE Network . . . . .	51
3.5	Summary . . . . .	57
<b>4</b>	<b>Novel Real-Valued Improved Coral-Reef Optimization Algorithm for Optimal Integration of Classified Distributed Generators</b>	<b>59</b>
4.1	Introduction . . . . .	59
4.2	Problem Formulation . . . . .	60
4.3	Optimal Placement of DGs . . . . .	60
4.3.1	Proposed Novel Approach of DG Placement through Particle Swarm Optimization-Coral Reef Optimization (PSO-CRO) Al- gorithm . . . . .	61
4.4	Result and Discussion . . . . .	70
4.4.1	33-Bus IEEE Network . . . . .	70
4.4.2	69-Bus IEEE Network . . . . .	77
4.4.3	118-Bus Radial Distribution System . . . . .	82
4.5	Summary . . . . .	87
<b>5</b>	<b>Optimal Reconfiguration of Radial Distribution Networks using PSO-CRO Algorithm for Loss Minimization and Voltage Stability Enhancement under Voltage Dependent Loads.</b>	<b>89</b>
5.1	Introduction . . . . .	89
5.2	Distribution Network Reconfiguration . . . . .	90
5.2.1	System Model . . . . .	90
5.2.2	Problem Formulation . . . . .	91
5.2.3	Mathematical Modelling of Voltage-Dependent Load . . . . .	92
5.2.4	Optimal Reconfiguration of Distribution Network . . . . .	93

5.3 Results and Discussion . . . . .	94
5.4 Summary . . . . .	98
<b>6 Conclusion</b>	<b>99</b>
6.1 Summary of the Important Findings . . . . .	99
6.2 Future Scope . . . . .	101
<b>References</b>	<b>103</b>
<b>Appendix A</b> Data for IEEE 33-bus Network	<b>113</b>
<b>Appendix B</b> Data for IEEE 69-bus Network	<b>115</b>
<b>Appendix C</b> Data for IEEE 118-bus Network	<b>119</b>
<b>List of Publications</b>	