Praise Worthy Prize

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Performance Improvement of Radial Distribution Network with Distributed Generation Integration Using Extended Particle Swarm Optimization Algorithm

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Abstract – *This paper proposes the performance improvement of radial distribution network with distributed generation (DG) integration using extended particle swarm optimization (PSO) algorithm. High-performance distribution network is a network that has a low power loss, better voltage profile, and loading balance among feeders. The effort to improve the performance of the distribution network is network configuration optimization. The optimization has become an important issue with the presence of DG in distribution networks. In this study, network configuration optimization is based on an extended PSO algorithm. The methodology has been tested in two models of IEEE radial distribution networks. The results showed that the optimal configuration of the distribution network is able to reduce power loss and to improve the voltage profile of the network significantly.*

Keywords: *Radial distribution, network reconfiguration, network performance, particle swarm optimization, distributed generation.*

Nomenclature

Q_{DG}	Reactive power of DG.
P_{loss}	Cost function of active power loss.
P_i	Active power flowing out of bus i.
Q_i	Reactive power flowing out of bus i.
n_b	Number of branch.
R_i	Resistance at bus i-th.
V_i	Voltage magnitude at bus i-th.
$V_{i,min}$	Lower voltage magnitude limits at bus i-th.
$V_{i,max}$	Upper voltage magnitude limits at bus i-th.
$I_{i,min}$	Lower current magnitude limits at bus i-th.
$I_{i,max}$	Upper current magnitude limits at bus i-th.
X_i	Position of the i-th individual of swarm.
V_i	Velocity of the i-th individual of swarm.
$V_i^{(t+1)}$	Modified velocity of particle.
$X_i^{(t+1)}$	Latest position of particle.
$Pbest_i$	Particle best experience of i-th.
$Gbest_i$	Best global position for swarm search i-th.
t	Number of iterations.
$rand_1(o)$	A random number between 0 and 1.
$Rand_2(o)$	A random number between 0 and 1.
N	Number of the swarm.
ω_{max}	Maximum inertia weight.
ω_{min}	Minimum inertia weight.
t_{max}	Maximum number of iterations.

I. Introduction

The uncertainty system load of a different feeder is highly variables, therefore the operation and control of power distribution systems become more complex, especially in areas that have a high load density. In this state the power loss in a distributed network will not minimum for a fixed network configuration for all cases of varying loads. Therefore, it is necessary to increase system performance through the distribution network reconfiguration. Distribution network reconfiguration is achieved by using sectionalizing switches that remain normally closed and tie switches that remain normally open. The main purpose of the reconfiguration is to minimize active power losses in order to improve distribution system performance [1]–[3]. Basically, the network is reconfigured to reduce the real power losses and to balance the load of each feeder. However, because of the dynamic nature of the load, the total load is more than the capacity of the generation system that makes eliminating the load on the feeder is not possible and hence the system voltage profile will not be upgraded to the required level. In order to meet the required level of load demand would require the DG unit is integrated in the distribution network. Until now, network reconfiguration and placement of DG in distribution networks are considered independent. However, in the proposed method, network reconfiguration and installation of DG handled simultaneously to increase the

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