Optimization of Radial Distribution Network with Distributed Generation Using Particle Swarm Optimization Considering Load Growth

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Abstract This article presents a combination of particle swarm optimization (PSO) algorithm and the backward/forward sweep power flow (BFSPF) approach to determine the optimal bus location and size of distributed generation (DG) in a radial distribution network (RDN) considering the load growth. The analysis of the proposed optimization framework is performed using MATLAB and tested on the 33–bus RDN subject to minimize the power losses. The solutions accomplished through the experiments considering four case studies show significant reductions in the system's total power loss and improvement in desired bus voltage profiles. With the installation of DG, the percentage of reduction in power loss is 47.38% compared to the system's power loss without DG. The DG size and location to be installed are determined at the 6th bus location with 2.59 MW. The results show that power losses will increase with the increase in load demand. The findings reveal that load growth does not influence the optimal location of the DG. However, the sizes of DGs need to be revised when considering growth in load conditions.

Keywords Distribution generation · Particle swarm optimization · Radial distribution network · Backward/Forward sweep power flow

1 Introduction

The electric power generation must be functioning as efficiently as possible by preventing all unwanted disruptions that may affect the quality of the electrical system [1]. A centralized electricity generating plant may include natural gas and coal, nuclear, etc. However, because of environmental concerns and the preservation of fossil fuels, alternative sources are being considered to conserve and mitigate the negative effect on the environment of these traditional power generating plants [2].

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