Multi-objective economic dispatch of distributed generation using differential evolution algorithm

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Abstract. Economic Dispatch (ED) deals with the allocation of the essential load amid the existing power plants such that the operating cost is reduced. The ED problem is framed as a nonlinear optimization problem with subjected constraints. In this study, a distributed generation (DG) optimization using a multi objective differential evolution (MODE) algorithm is explored. This study aims to find out the minimum fuel cost, environmental pollution penalty cost and minimum system real power loss. MODE algorithm is implemented on 33-bus distribution system (DS) to obtain the ideal real power dispatch of DGs. Four DGs are considered which having two diesel generator, one wind generator and one fuel cell. The result shows the minimized value of Fuel/Emission penalty cost and power loss in the DG units using MODE algorithm when compared with Multi Objective Particle Swarm Optimization (MOPSO) algorithm.

Keywords: DG, Fuel cost, Pollutant emission, MODE, Optimal real power dispatch, MOPSO.

1. Introduction

Globally, the DGs are getting huge consideration due to the raising need for unpolluted and renewable energy sources (RES). DG delivers voltage sustenance to the bulky DS which offers reliability enhancements and real power loss minimization. DGs are eco-friendly and enhancing energy conservation. It reduces the complexity of RES for instance wind power and solar photovoltaic power. Determining an ideal DG yield is an interesting investigation concept, particularly taking the multiple objective functions with various DGs penetration [1]. Usually, these problems have been solved with single objective function involving weighting factors. But it has the drawback of estimating a single result without the trade-offs between the two dissimilar objectives. Estimating several solutions by this method (with different weighting factors) needs numerous simulations with dissimilar factors that may increase the execution time [2, 3]

Modern investigations have tackled the objective functions concurrently and autonomously as a real world problem. Though, it turn out to be complex owing to the concerns such as steadiness, local optima, and linearization. Recently, metaheuristic techniques, for instance PSO, DE, and evolutionary programming (EP) were implemented to power system problems and have offered decent outcomes. Recently, DE [4] has been implemented to solve a multi-objective OPF problem. The active and reactive power dispatch have been deliberated as the constraints. The implementation procedure for executing multi-objective evolutionary algorithm (MoEA) has been provided in [5]. In [6], pareto-based MoEA has