An Improved Non-dominated Sorting Genetic Algorithm III with Grey Relational Analysis Decision Making for DG Placement and Sizing

Norainon Mohamed[1] and Dahaman Ishak[2(✉)]

[1] Faculty of Electrical and Electronics Engineering Technology, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia
norainon@ump.edu.my

[2] School of Electrical and Electronics Engineering, USM Engineering Campus, 14300 Nibong Tebal, Penang, Malaysia
dahaman@usm.my

Abstract. In this paper, an improved Non-dominated Sorting Genetic Algorithm III (NSGA III) is proposed in determining the location and sizing of multi-DGs. NSGA III is the new variant of pareto-based evolutionary algorithm by using reference point approach. Grey Relational Analysis (GRA) is used to determine the best compromise among the non-dominated pareto solutions. Considering that minimization of power losses and improvement of voltage profile as the objectives, the proposed method is applied to IEEE 14 bus system. The obtained results are comprehensively compared with other published works. From this comparative analysis, it is proved that the proposed algorithm is very effective in reducing the line losses and improving the voltage profile.

Keywords: Voltage profile · Line loss minimization · Voltage stability · NSGA III

1 Introduction

In developing countries, electricity demand has gradually increased every year. However, in March 2020, the world has been imposed with the global lockdown due to the new virus outbreak called COVID-19. The World Health Organization (WHO) has declared this outbreak as a pandemic [1]. Due to the lockdown, the energy demand had dropped significantly in industrial and commercial loads, but increasing the residential load demand because of the sudden changes in lifestyle where people are forced to work from home since the social distancing restriction is the best approach to control the spreading of this COVID-19 outbreak. The impact of this pandemic has opened the door of opportunity to the utility companies to improve the power grid networks in facing this new norm.

Shifting of dispatch profile due to higher demand in residential loads may cause higher stress in equipment and potentially lead to higher power losses and voltage instability. This mentioned problem can be solved by the integration of distributed generations (DGs) located not only at distribution but also at the transmission side.

N. M. Mahyuddin et al. (Eds.): *Proceedings of the 11th International Conference on Robotics, Vision, Signal Processing and Power Applications*, LNEE 829, pp. 772–778, 2022.
https://doi.org/10.1007/978-981-16-8129-5_118