Voltage Profile Improvement in Electricity Distribution Networks – A Genetic Algorithm Benchmark Study

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***Abstract*—Voltage quality is an essential requirement in the operation of electricity distribution systems. At consumer busbars, the deviation from the nominal voltage has specific ranges, prescribed in technical regulations. A widely used voltage correction approach is to use reactive power compensation. Capacitor banks are used for this purpose in highly loaded networks, but their placement and sizing requires optimization. Metaheuristic methods are frequently used for parallel optimization problems, and the Genetic Algorithm (GA) is a very well-known metaheuristic technique. However, the performance of the GA is highly dependent on the settings chosen by the user. This paper investigates the influence of the crossover type used on the results of the GA applied to the problem of voltage profile improvement using reactive power compensation with capacitor banks in electricity distribution networks.**

***Keywords*—electricity distribution networks, voltage profile improvement, capacitor banks, genetic algorithms, crossover.**

REFERENCES

[1] J.H. Holland, "Adaptation in Natural and Artificial Systems", University of Michigan Press, 1975.
[2] J. Kennedy, R. C. Eberhart, "Particle Swarm Optimization", in Proc. of IEEE Intl. Conf. on Neural Networks. Piscataway, NJ: IEEE Service Center, pp. 1942-1948, 1995.
[3] J. Vuletic, M. Todorovski, "Optimal capacitor placement in distorted distribution networks with different load models using Penalty Free Genetic Algorithm. Int. J. of Electrical Power and Energy Syst., no. 78, pp.174-182, 2016.
[4] S. R. Gampa, D. Das, "Optimum placement of shunt capacitors in a radial distribution system for substation power factor improvement using fuzzy GA method" Int. J. Electr. Power Energy Syst., no.77, pp.314–326, 2016.
[5] H. Kim, S. K. You, "Voltage Profile Improvement by Capacitor Placement and Control in Unbalanced Distribution Systems using Genetic Algorithm" IEEE Power Engineering Society Summer Meeting, no. 2, pp. 800-805, 1999.
[6] M. M. Baiek, A. Esmaio, M. Nizam, M. Anwar, H. Atia, "Derivative load voltage and particle swarm optimization to determine optimum sizing and placement of shunt capacitor in improving line losses." J. of Mechatronics, Elect. Power, and Vehicular Techn., vol. 7, no. 2, pp. 67-76, 2016.
[7] M. Gheydi, M. J. Golkar, "Optimal capacitor placement in distribution network with consideration of annual load profile: case study Meshkinshahr distribution network", 42nd Annual Conf. of the IEEE Industrial Electronics Society, 2016.
[8] Y. Mohamed Shuaib, M. Surya Kalavathi, C. Christober, A. Rajan, "Optimal capacitor placement in radial distribution system using Gravitational Search Algorithm", Int. J. Electr. Power Energy Syst., 64, 384–397, 2015.
[9] A. Y. Abd-Elaziz, E. S. Ali, S. M. Abd-Elazim, "Flower pollination algorithm and loss sensitivity factors for optimal sizing and placement of capacitors in radial distribution systems", Int. J. Electr. Power Energy Syst., 78, 207–214, 2016.
[10] B. C. Neagu, O. Ivanov, G. Georgescu, "Reactive power compensation in distribution networks using the bat algorithm". In. Int. Conf. on Electrical and Power Engineering, EPE, pp. 711-714, 2016.
[11] J. Sharma, R.S. Singhal, "Comparative research on genetic algorithm, particle swarm optimization and hybrid GA-PSO", Proc. Of 2nd Intl. Conf. on Computing for Sustainable Global Development (INDIACom), New Delhi, India, pp. 110 – 114, 2015.
[12] O. Ivanov, B.C. Neagu, M. Gavrilas, "A Parallel PSO Approach for Optimal Capacitor Placement in Electricity Distribution Networks", The 7th Intl. Conf. on Modern Power Systems (MPS), 6-9 June, 2017.