Solving optimal power flow problem with stochastic wind–solar–small hydro power using barnacles mating optimizer

Mohd Herwan Sulaiman[a], *Zuriani Mustaffa*[b]
[a]Faculty of Electrical & Electronics Engineering Technology, Universiti Malaysia Pahang (UMP), 26600 Pekan Pahang, Malaysia
[b]Faculty of Computing, Universiti Malaysia Pahang (UMP), 26600 Pekan, Pahang, Malaysia

ABSTRACT
Optimal Power Flow (OPF) is a complex and challenging problem in power system that includes non-convex and non-linear constrained optimization problems. Due to these features, solving the OPF problem is becoming a well-known area to be solved by researchers for the past decades especially involving with the proper optimizing of the control variables. This issue is vital to be solved in achieving the objectives while maintaining of the stability of the system. In this paper, recent metaheuristic algorithm namely Barnacles Mating Optimizer (BMO) will be used to solve three objective functions of OPF problem viz. (1) cost minimization of the power generation that consists of thermal and stochastic wind–solar–small hydro power generations, (2) power loss minimization, and (3) combined cost and emission minimization of mentioned power generations. To assess the performance of BMO into OPF problem, modified IEEE 30-bus and IEEE 57-bus systems that incorporate the stochastic wind–solar–small hydro power generators will be employed. Statistical studies are performed to show the feasible and effectiveness of BMO compared with other selected metaheuristic algorithms. Based on the obtained results, the BMO has shown the best results for all cases of simulation study. For example, the cost of power generations obtained by BMO for IEEE 30-bus and IEEE 57-bus systems are 789.1248 $/h and 5300.457 $/hr, respectively which 1.45% and 2.2% cost saving per hour compared to the worst results obtained from compared algorithms. The results suggest that BMO performs better compared to the rest of algorithms and demonstrate as effective alternative for the OPF problem solution.

KEYWORDS
Barnacles mating optimizer; Cost and emission minimizations; Loss minimization; Metaheuristic algorithms; Optimal power flow

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