Chapter 34
Enrichment of Distribution System Stability Through Artificial Bee Colony Algorithm and Artificial Neural Network

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ABSTRACT

In this chapter, an amalgamation of artificial bee colony (ABC) algorithm and artificial neural network (ANN) approach is recommended for optimizing the location and capacity of distribution generations (DGs) in distribution network. The best doable place in the network has been approximated using ABC algorithm by means of the voltage deviation, power loss, and real power deviation of load buses and the DG capacity is approximated by using ANN. In this, single DG and two DGs have been considered for calculation of doable place in the network and capacity of the DGs to progress the voltage stability and reduce the power loss of the system. The power flow of the system is analyzed using iterative method (The Newton-Raphson load flow study) from which the bus voltages, active power, reactive power, power loss, and voltage deviations of the system have been achieved. The proposed method is tested in MATLAB, and the results are compared with particle swarm optimization (PSO) algorithm, ANN, and hybrid PSO and ANN methods for effectiveness of the proposed system.

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INTRODUCTION

Losses are a very key role when constructing and arrangement of the power system. Losses are predictable in every set of links; however, the quantity can fluctuate considerably depending on the planning of the power system. The power flows in the system decide the loss. One of the largest consumer markets in the world is the electric power industry. The cost of electricity is estimated at around 50% for fuel, 20% for generation, 5% for transmission and 25% for distribution. Distribution systems must deliver electricity to each customer's service entrance at an appropriate voltage rating. The X/R ratio for distribution levels is low as compared to transmission levels, causing high power losses and a drop in voltage magnitude along radial distribution lines. Studies have indicated that just about 13% of the total power generated is consumed as real power losses at the distribution level. Such non-negligible losses have a direct impact on the financial issues and overall efficiency of distribution utilities. The installation of Distributed Generation (DG) units is becoming more famous in distribution systems due to their overall positive impacts on power networks such as energy competence, deregulation, diversification of energy sources, ease of finding sites for smaller generators, shorter erection times and lesser investment costs of smaller plants, and the nearness of the generation plant to heavy loads, which decreases transmit costs. (K. Varesi, 2011) Hence the allotment of DG units gives a possibility to decrease power loss (S. A. Hosseini, M. Karami and S. S. KarimiMadahi, 2011 &NareshAcharya, PukarMahat and N. Mithulananthan, 2006& Nadweh et al,2018).

The addition of Distributed Generation (DG) units changes the load features of the distribution system, which slowly becomes an active load network and involves changes in the power flows. The performance of the network by addition of each DG can be determined by performing the load flow solution. For that reason, it is required to build up mathematical optimization that can be implemented in the network to decrease the power loss and to maintain the voltage magnitudes at each bus within the acceptable limits. Hence the author is interested in the area of optimization methods in the domain of Smart Micro-Grid and power system operation and control. The different optimization methods for improvement of performance of the network are already developed such as Genetic Algorithm (GA), Particle swarm optimization (PSO), Artificial Neural Network (ANN) and Artificial Bee Colony (ABC) etc. are supportive for optimizing the DG size and location in decreasing the power loss and for enhancement of voltage profile (F. S. Abu-Mouti, El-Hawary, 2011 &H. Nasiraghdam and S. Jadid, 2012& Madisie et al, 2018).A hybrid technique which is the amalgamation of Particle Swarm Optimization (PSO) and Artificial Neural Network (ANN) has been implemented to find out the optimal location and rating of DG to diminish the power loss in the network and voltage profile enhancement at all buses (F. S. Abu-Mouti and M. E. El-Hawary, 2009 & Gummadi SrinivasaRao and Y.P.Obulesh, 2013).In 2016 (Hassan Haes Alhelouand M. E. H. Golshan, 2016) A high penetration level of RERs causes some problems to the grid operator, e.g., lack in primary reserve. This paper proposes a new scheme to provide necessary primary reserve from electric vehicles by using hierarchical control of each individual vehicle. The proposed aggregation scheme determines the primary reserve and contracts it with system operator based on electricity market negotiation.

A comprehensive literature reviews and state of arts in nature inspired optimization algorithm could be found in (Mehdi Khosrow-Pour, 2018). In this Incorporating Nature-Inspired Paradigms in Computational Applications is a critical scholarly resource that examines the application of nature-inspired paradigms on system identification.In this year (H. HaesAlhelou,M.E. HamedaniGolshan and J. Askari-Marnani, 2018), propose the use of unknown input observer for detection of faults in interconnected smart power