

Application of Genetic Algorithm in Electrical Engineering

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Abstract

In these days, the artificial intelligent techniques play a vital role in controlling of the system. Out of them, Genetic Algorithm (GA) is the better tool to use to control the complex process or to solve the complex problems. The GA is used to find the global optimum solution and it is the technique of natural selection to find the optimum solution. Electrical Engineering is the one of the branches of Engineering where the system is gigantic and complex. In Electrical Engineering, the application of GA made the system easy to control in various aspects. In this paper, the application of GA in Economic Load Dispatch, Reactive Power Control and Power Flow are discussed.

Keywords : Electrical Engineering, Artificial Intelligence, Genetic Algorithm, Power Flow.

1 Introduction

The Genetic Algorithm is the very useful tool to get the optimum solution for many complex problems. The Electrical Engineering

has a gigantic and very complex system. The main parts of Electrical Engineering are generation, transmission and distribution. All these places, there are so many problems. The clear monitoring system is established to handle all these problems. GA is the one of the highly implemented artificial intelligent tool to control these types of complex problems.

The organization of the paper is as follows:

2. GA basics
3. Economic Load Dispatch [1-6]
4. Reactive Power Control [7-16]
5. Power Flow Studies [17-20]

2 Genetic Algorithm

Genetic Algorithm is the method to select the naturally and it creates a population of chromosomes to determine the fitness and select next generation to perform reproduction using crossover and later perform the mutation to find the best values. Genetic Algorithm is a meta heuristic search technique and it is a direct random search method that relies on to the mechanism of natural selection. GA is very different from the most of the traditional optimization methods. It is also used to find the optimum solutions of continuous and differential functions, these methods are analytical and make use of the technical calculation.

Selection:

Selection rule randomly select the parents for next generation. Cross over:

Cross over rules creates a next generation with children by combining two parents.

Mutation:

Mutation rules applies a random changes to individual parents for forming children.

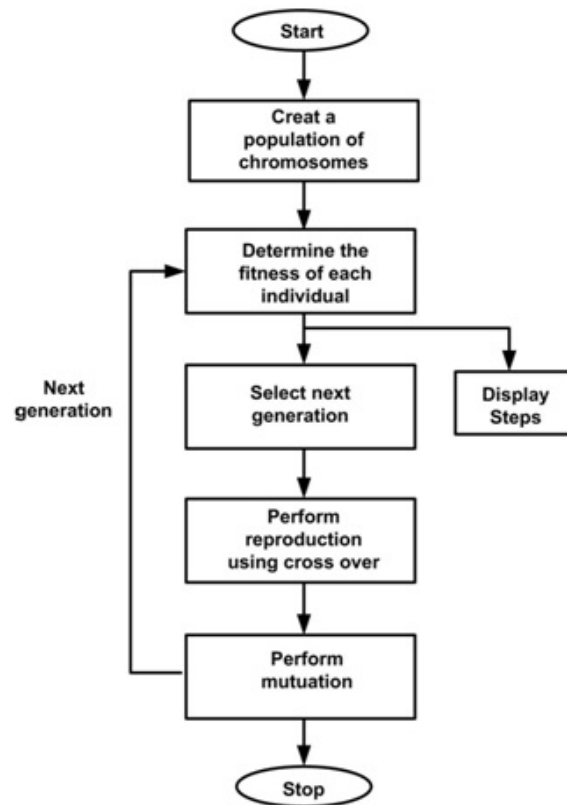


Figure 1: Flow chart of GA

3 Economic Load Dispatch

To fulfill the load demand, the real and reactive power vary within the limits with less fuel cost to meet the requirement of energy the electric power system size should be increased rapidly. The GA is used to find the ramp rate for generating units the genetic algorithm simulated annealing is tested for 10 generating system, and GA is based on the MOL solutions and MOL methods for getting quality of GA-SA against it is compared with the 20 and 40 generating unit system [1]. The GA proposed the parallel micro grid generating algorithm (PMGA) is used for parallel machines, and the constrained economic dispatch problems are solved by GA for generating units in increasing incremental functions .The GA is

tested on the systems for connecting PMGA parallel to machines there have a some problems for clearing that problems the GA is used as a PMGA[2]. The Bid-Based dynamic economic dispatch is solved by the Niche immune GA for various load demands the generation of cost is maximized but Bid-Based dynamic economic dispatch is used to maximize social profit under various environment and market in electricity, and proposed Niche immune GA is the effective solution[3]. The GA is used as a simple and RGA (Refined Genetic Algorithm) due to operational constraints these two methods are used to find the minimization cost for economic load dispatch so in this paper it improves the GA performance [4]. With the use of MATLAB, IEEE 14 Bus and IEEE 30 Bus are used to test the transmission lines and the work is modeling the economic load dispatch for solving the problems. Two concepts are used in [5], those are genetic algorithm and quadratic programming. Now a days, economic load dispatch is a emerging problem with the existence of thermal power plant which is a renewable energy source and find difficult to optimize the solution, so to reduce the fuel cost genetic algorithm is used and it gives the optimal solution and considering problem is economic load dispatch and constraint is wind power the GA is based on the problem only [6].

4 Reactive Power Control

Reactive power control is the major issue in smooth flow of the electrical power both at distribution side and transmission side. Many artificial intelligent techniques were used in controlling the reactive power viz. 1. Fuzzy Logic Controller [8-9] 2. Neural Network Controller [11-12] 3. Neuro Fuzzy Controller [14-15]

Reactive power flow problem in power system at distribution side and transmission side, to control the reactive power different types of controllers are used ,here the GA is used to control the reactive power flow control. GA is mainly used to optimize the non linear equations, the problem is reactive power dispatch and voltage control in the power system and here the GA is applied to the VAR, the initial population is generated through pseudo random generator [7]. GA is used for optimizing the problem using 6 bus,

and the real power and reactive power flow has been studied with the usage of GA the optimization process is done with the reactive power then the bus voltage magnitude is limited [10]. The GA is used to optimize the reactive power and controlling the voltage because the non linear load create a harmonics and reactive power, with the optimization technique it can be reduced the GA can be named as a IDGA (Improved Dynamic Genetic Algorithm)[13], [16].

5 Power Flow Studies

The power flow is considered as to minimize the objective function which represent the generation cost/transmission loss. This is frequently solve by using optimization technique. GA is the best method to solve the optimization technique when compared with the conventional method. The conventional methods are used to find the local minima or local maxima but the GA is used to find the global maxima or global minima so the GA is also applied at the power systems to find the problems at transmission lines and to optimize it [17]. To reduce the real and reactive power by GA along with FACTS controllers, in this paper newton raphson method is used to among the FACTS controller static VAR is consider in this work [18]. In electrical power systems had damping oscillations and the load is increasing with the growth of generations, the objective of this paper [19] is at high voltage power is static stability and electrical network, this paper shows a new approach to find the optimal tuning of power system with the use of GA and getting the Eigen values that should be verified at the infinite bus. Distributive Power Flow Controller (DPFC) improving the power systems with GA and DPFC contains three controllers are central, series and shunt control. The shunt and series are in STATCOM and central control consists a one shunt power converter and five series converter [20].

6 Conclusion

The Genetic Algorithm is one of the best artificial intelligent techniques to get the optimum values of many complex problems. In this paper, the application of GA in very gigantic system like Elec-

trical Engineering is considered. The main problems of Electrical Engineering are Economic load dispatch, reactive power control and power flow studies are considered in this paper. The various research papers in these areas were referred and discussed in this paper.

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