

Optimal solution for Economic Load Dispatch using Genetic Algorithms

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ABSTRACT

In a practical power system, the power plants are not located at the same distance from the center of loads and their fuel costs are different. Also, under normal operating conditions, the generation capacity is more than the total load demand and losses. Thus, there are many options for scheduling generation. In this paper, Economic Load Dispatch (ELD) of real power generation is considered. Economic Load Dispatch (ELD) is the scheduling of generators to minimize total operating cost of generator units subjected to equality constraint of power balance within the minimum and maximum operating limits of the generating units. In this paper, genetic algorithms are considered. ELD solutions are found by solving the conventional load flow equations while at the same time minimizing the fuel costs.

INTRODUCTION

The efficient and optimum economic operation of electric power systems has always occupied an important position in electric power industry. In recent decades, it is becoming very important for utilities to run their power systems with minimum cost while satisfying their customer demand all the time and trying to make profit. With limited availability of generating units and the large increase in power demand, fuel cost and supply limitation, the committed units should serve the expected load demand with the changes in fuel cost and the uncertainties in the load demand forecast in all the different time intervals in an optimal manner.

The basic objective of ELD of electric power generation is to schedule the committed generating unit outputs, so as to meet the load demand at minimum operating cost while satisfying all unit and system equality and inequality constraints. ELD involves different problems. The first is unit commitment or pre-dispatch problem where it is required to select optimally out of the available generating sources to meet the expected load and provide a specified margin of operating reserve over specified period of time. The second aspect of ELD is on-line economic dispatch where it is required to distribute load among the generating units actually parallel with the system in such a manner as to minimize the total cost of supplying power. In case of ELD, the generations are not fixed but they are allowed to take values again within certain limits so as to meet the particular load demand with minimum fuel consumption.

Theory of ELD

The economic load dispatch can be defined as the process of allocating generation levels to the generating units, so that the system load is supplied entirely and most economically. For an interconnected system, it is necessary to minimize the expenses. The economic load dispatch is used to define the production level of each plant, so that the total cost of generation and transmission is minimum for schedule of load. The objective of ELD is to minimize overall cost of generation. The method of ELD for generating at different loads must have total fuel cost at the minimum point. In a power system, multiple generators are implemented to provide total output to satisfy a given total consumer load. Each of these generating stations has a unique cost for over characteristic for its output operating range. A station has incremental operating cost for fuel and maintains and fixed cost associated with station its self that can be quite considerable in the case nuclear power plant.

Load Dispatching

The operation of modern power system has become very complex. It is necessary to maintain frequency and voltage within limits in addition to ensuring reliability of power supply and for maintain the frequency and voltage within limits it is essential to match generation of active and reactive power with the load demand. For ensuring reliability of power system it is necessary to put additional generational generation capacity into the system in the event of outage of generating equipment at some station. The total interconnected network is controlled by the load dispatch center. The load dispatch center allocates the MW generation to each grid depending up on the prevailing MW demanding that area. Each load dispatch center control load and frequency of its own by matching generation in various generating stations with total required MW demand plus MW loss. Therefore, the task of load center is to keep exchange of power between various zones and system frequency at desired values.

Generator Operating Cost

The total cost of operation includes the fuel cost, cost of labor, suppliers, and maintenance. Generally cost of labor, suppliers and maintains are fixed percentages of incoming fuel cost. The power output of fossil plants is increased by opening set of valves to its steam turbine at the inlet