CHAPTER

6

AQUILA OPTIMIZATION TECHNIQUE FOR GENERATOR CONSTRAINT

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6.1 INTRODUCTION

The power system network is one of the most important sectors in the world. The urge to produce and transmit good quality of power in the most efficient way is still a concern to the electrical engineer nowadays. The power system network is still improving day by day while trying to solve several problems related to it, starting from the generation process, the questions of what the most effective fuel is to use, what is the impact on the environment, how is the quality of the power generated. Despite that, there is a big problem that will come with every other problem, which is the cost or the economic sector.

In a normal scenario of industry-driven production, to produce more money, the production cost needs to be lowered, but not the quality of the product. This situation also happens in the power industry, the cost of generating power needs to be lowered so that the bill for the customer does not rise higher abruptly. One of the methods to reduce the generation cost is economic dispatch (ED). ED will be covered in this study using the aquila optimization technique along with the generator constraint.

Nowadays, as the cost of fossil fuels keeps increasing, the bill for electricity is rising accordingly, and it is part of the duty to find an alternative to hold or even decrease the rising bills. Several methods have been proposed to tackle this matter, and the proposed method is by using Economic Dispatch. It is usual to analyze the economic dispatch by manual calculation if the bus system is relatively small, but when it comes to real-world problems, the system is not as small as mentioned in manual calculations.

To calculate the economic dispatch in the real world, machine help is needed. In this study, MATLAB is the main tool for analysis. By formulating the correct code, it is expected to handle a system that is hard to apply manual calculation. With the aid of an optimization technique, it is expected that the combination of both the aquila optimizer (AO) and ED to analyze the complexity of the system, such as the generator sizing and the constraints.

Generator limits are the generation output limitations that are different for each generator, this is related to the specification of the generator. It is important to set a generator limit, since the purpose of ED is to find the optimal generation cost, then the optimizer tends to go over the limit to reach the optimal generation cost.

6.2 LOAD POWER SYSTEM ECONOMIC DISPATCH

The electric power utility's goal is to provide a reasonably priced and stable supply of electricity to meet the load demand at the possible minimum cost of operation along with the constraints from each of the generators available. ED is defined as a process of allocating the generation levels towards all the generating units, so that the demand of loads is fulfilled in the most economical way (Chowdhury & Rahman, 1990). Going back to the 1920's, ED problems have been cleared by using some methods, for example, the baseload method. In this method, the most efficient generating units must work at the maximum performance, and if the demand for power increases, the second most efficient unit will turn on (Happ, 1977). A decades after that, the incremental cost method, or the

equal increment method was starting to generate the most economical outputs. The method is that the lowest incremental cost unit will supply the next increment load (Obio et al., 2022).

There are several factors that need to be considered before running the ED:

(1) The generation cost
Cost is one of the biggest concerns for a generator when dispatching the units economically. The ED leans more towards the short-term operating cost, which is mainly around the fuel cost and the operating costs. Another concern of generating units that will affect the ED is the maximum or minimum generation level when the units are working, this will directly affect the schedule of the ED.

(2) The price
The price that comes from the power supplier will need to be considered before running the ED. In many places around the world, the electric supply is still handled by a single authority, this creates no competition, and the rates charged to the customer will surely be profitable to them. In other places, where there is competition among energy suppliers, the supply and demand theory are applied. If one supplier sets the price far below the competitor, bankruptcy will soon reach them.

(3) The quantity supplied
The total demands from customers also need to be considered before planning the ED. When there is only a single utility handling the supply, then that supplier needs to activate more or fewer generating units regarding the demands of the customer that later will be charged.

6.3 AQUILA OPTIMIZATION TECHNIQUE

In the northern part of the earth, Aquila is one of the most famous predator birds. The typical body color of an Aquila is dark brown, with light golden-brown on the back of the neck. The younger Aquila mostly will have white color on the tail and slight white marks on their wings.