Chapter 12
Multi-Fuel Power Dispatch Considering Prohibited Operating Zones and Tie-Line Flow Limits Using Ant Lion Optimizer

Ganesan Sivarajan
Government College of Engineering, Salem, India

Jayakumar N.
Government Polytechnic College, Uthangarai, India

Balachandar P.
Government Polytechnic College, Valangaiman, India

Subramanian Srikrishna
https://orcid.org/0000-0002-9888-5382
Annamalai University, India

ABSTRACT

The electrical power generation from fossil fuel releases several contaminants into the air, and these become excrescent if the generating unit is fed by multiple fuel sources (MFS). The ever more stringent environmental regulations have forced the utilities to produce electricity at the cheapest price and the minimum level of pollutant emissions. The restriction in generator operations increases the complexity in plant operations. The cost effective and environmental responsive operations in MFS environment can be recognized as a multi-objective constrained optimization problem. The ant lion optimizer (ALO) has been chosen as an optimization tool for solving the MFS dispatch problems. The fuzzy decision-making mechanism is integrated in the search process of ALO to fetch the best compromise solution (BCS). The intended algorithm is implemented on the standard test systems considering the prevailing operational constraints such as valve-point loadings, CO_2 emission, prohibited operating zones and tie-line flow limits.

DOI: 10.4018/978-1-7998-3970-5.ch012

MULTI-FUEL POWER GENERATION DISPATCH (MFPGD)

In practical conditions of power system operations, different Fuel Sources (FS) like coal, natural gas and oil supply certain generating units. The cost function for each fuel type is derived and is segmented as Piecewise Quadratic Cost Function (PQCF) for a generating unit fed by Multiple Fuel Sources (MFS). These generating units face with the dilemma of finding out the most economical fuel to fire. Further, the operational complexity is increased while considering the valve-point discontinuities and prohibited operating zones. Now-a-days, Emission Control (EC) is likewise an important objective, which must be weighed along with fuel price. The emission function can also be approximated like the Fuel Cost (FC). Therefore, the process becomes trickier when the conflicting objectives (total operating cost and pollutant emission) are taken in concert. The solution process is detailed in Figure 1.

SOLUTION METHODS

The solution approaches addressing this problem can be categorized into mathematical and heuristic methods. The research reports addressed the multi-fuel power dispatch problems are briefed in this section.

Figure 1. Solution procedure to multi-objective multi-fuel generation dispatch