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Abstract (172 Kb)

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Economic Load Dispatch with Emission and Line Constraints using Biogeography Based Optimization Technique

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Abstract: Economic load dispatch is the economic loading of different generating units for variable load conditions of any power system. Emission contributions of conventional thermal power plants plays major role in the overall air pollution. The total emissions need to satisfy the allowable limits of the emission. This paper proposes the load scheduling for combined economic emission and load dispatch (CEELD) problems. In this paper, Biogeography Based Optimization (BBO) technique is employed to estimate the fuel cost and emission of all the generating units. The aim of this paper is to minimize the fuel cost and emission of all the units for a given load. Result obtained by BBO are compared with the results obtained by different other optimization techniques such as genetic algorithm (GA), particle swarm optimization (PSO), evolutionary programming (EP) and differential evolution (DE) with respect to total fuel cost, solution time and convergence criteria. The proposed BBO technique is employed on a standard IEEE 30 bus - 6 generator power system to obtain the CEELD solution. The BBO algorithm is carried out in MATLAB environment. The solutions obtained by BBO technique are quite encouraging.

Index Terms: Economic Load Dispatch, Emission, Optimization, CEELD, BBO.

I. INTRODUCTION

The main goal of economic load dispatch (ELD) is to allocate the total power demand among all the committed generators to attain minimum fuel cost. The cost of fuel is a major component in the total cost of power generation in conventional fossil fuel plants. Therefore, economic load dispatch helps in reducing a substantial amount of fuel cost. Traditional methods such as gradient methods, lambda iteration etc. are depends on the convexity hypothesis of cost curves. Approximation of cost curves are to be done by monotonically increasing quadratic cost functions [1]. The cost functions of generating units have various nonlinearities and discontinuities due to prohibited operating zones, ramp rate limits and valve point loading of generators [2-5]. Therefore, it's very difficult to obtain global minima in presence of these nonlinearities with multiple minima [6-7]. Various conventional optimization techniques are used to solve ELD problem. Most of methods are not able to efficiently solve the optimization problems with non-continuous, non-convex, and highly non-linear problems [8-9]. Some researchers investigate the practicability of

developing a method to solve CEELD [10]. A new concept of price penalty factor is proposed by some researchers for solving CEELD problem tounifies the emission costs with the fuel costs [11-13].

CEELD minimizes the overall production cost with minimum emission with fulfilling the load demand. The fuel cost function is taken in the quadratic form [14]. It increases non-linearity while considering valve point effects [15-16]. BBO algorithm gives modern advances in computation and improved outcomes of complex optimization problems [17-18]. BBO algorithm is very efficient and precise technique for obtaining global optimal solution with non-convex, non-continuous and extremely non-linear solutions [19-23].

This paper presents the application of BBO to obtain ELD by optimize the fuel cost. Emission through these generating units are also taken into consideration. Economic emission load dispatch is estimated by employing BBO. Propose BBO methodology for CEELD problem is employed on an IEEE 30-bus, 6-generator power system to establish its efficacy. Result obtained by BBO are compare with the results obtained by different intelligent techniques such as particle swarm optimization (PSO), genetic algorithm (GA), differential evolution (DE) and evolutionary programming (EP) in reference to overall fuel cost, process period and convergence benchmarks [24].

II. ECONOMIC LOAD DISPATCH (ELD)

It is not easy for power generating stations to satisfying the consumer power demand with optimum cost. In general, power systems consist multiple generating stations having number of generators. The generating cost does not usually associate proportionally with their power output, therefore economic loading of different generators to supply the desired total load is a challenge. The economic load dispatch (ELD) is the economic generation scheduling of all generating units to curtail the overall generation cost meeting all generating and transmission constraints.

III. Biogeography Based Optimization (BBO)

Biogeography based advancement (BBO) is the investigation of the topographical circulation of natural creatures with space and time. BBO has certain unique features which overcome demerits of other optimization