

# A Review of Recent Methods which are used for the solution of Economic Dispatch (ED) problem of Power System

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**Abstract**—This papers presents a review of various methods that are currently employed for the solution of classical Economic Dispatch (ED) problem of power system. It starts with a brief summary of early work in this field. The recent techniques that are based on Steepest Decline method, Local minimum analysis, Risk constrained method, Cross-Entropy method are reviewed next. The usage of Distributed Dynamic programming based approach is discussed and reviewed. This method refers to the discrete economic dispatch problem and its formulation. Lastly, a review of Bisection method is provided in the paper.

**Keywords**—*Distributed algorithm; Economic Dispatch; Smart grids; Quadratic programming; Unit commitment risk.*

## I. INTRODUCTION

Optimal power (load) scheduling is an important problem for any electric utility system. Its importance has been further enhanced with the development of large integrated power systems. The solutions of optimal power scheduling problem gives generation schedules at various generating plants, such that power demand is met at minimum possible operating cost and the system constraints are satisfied. The problem has assumed increasingly higher importance and priority as the operating costs continue to escalate and main thrust of the system analysts being on conservation of conventional fuels such as coal and oil. For these reasons, the optimal power scheduling problem still continues to be an important subject for carrying out extensive research for finding newer algorithms and methods for achieving the above mentioned objectives.

Early work in this area was that of Kirchmayer in fifties who solved an all-thermal system problem, employing coordination equations derived by the Lagrange multiplier technique. In this formulation, the effects of the equality and inequality constraints imposed by the transmission and generating systems were either approximated or completely ignored. Carpentier in 1962 for the first time advanced an exact formulation of an all-thermal system dispatch problem, taking into consideration the several equality and inequality constraints of the system, which were not considered by the earlier researchers. Subsequently, several algorithms for solution were proposed in the literature to solve the problem as formulated by Carpentier.

Despite the extensive research focusing on optimal power scheduling, most of the efforts to-date have been mainly centered around development of deterministic models applicable to steady state conditions. The system data has normally been assumed to be known with complete certainty i.e. deterministic.

This paper provides the review of the recent methods that are used in the solution of the ED problem.

## II. LITERATURE REVIEW OF RECENT METHODS

### A. Steepest decline method

First, the usage of evolutionary algorithms is shown to be the only feasible approaches for solution of ED with prohibited zones in [1]. This paper describes the usage of dimensional steepest decline method for the solution of ED. This method is based on the local minimum analysis of the ED problem [1]. The decline rate is used as an important index in finding the optimal solution. This paper analyses the computational complexity involved on the method.

### B. Local Minimum Analysis

Economic dispatch with valve-point effect is shown to be a precise modeling of the Ed problem in [2]. It is a multi-model optimization [2]. This describes a local minimum analysis of the ED problem with valve-points. A traverse search is also described here.

## III. RISK CONSTRAINED ECONOMIC LOAD DISPATCH

A new method for risk constrained unit loading for interconnected systems is given in [3]. This makes use of least costly deviation from economic load dispatch to satisfy the risk criteria [3]. The technique is developed on the basis of each area in a multi-area configuration fulfilling different risk criteria [3].

#### A. *Sequential Quadratic Programming*

A new hybrid approach is presented in [4]. This combines the cross-entropy algorithm and sequential quadratic programming technique to find the solution of Ed problem. The comparison of the method with several state-of-the art approaches are demonstrated in [4].

#### B. *Distributed Dynamic Programming Based Approach*

The discrete economic dispatch problem is formulated in [5]. A new strategy utilizing dynamic programming approach is described. It is implemented for a multi-agent system. This allows the sharing of computational and communication resources. This scheme can be implemented with asynchronous communication, thus leading to simpler implementations [5].

#### C. *Distributed Bisection Method*

A fully distributed bisection algorithm for the solution ED problem is given in a smart grid scenario [6]. This algorithm uses the method of bisection and it is based on a consensus-like iterative method, with no need for a central decision maker or a leader node [6]. The convergence of the method is shown under strong connectivity conditions and allowance for local communications [6]. A description of two stopping criteria is also provided.

### IV. CONCLUSION

After the usage of deterministic algorithms for the solution of Ed problem, recently new algorithms are employed for its solution. This paper has presented some of the recent

techniques which are used in the current context. These methods provide a new direction for the researchers in the field. How the trend is shifting from the classical approaches to newer algorithms that are capable of including uncertainty in the solution? This fact is evident from the various approaches that are presented in the paper.

### References

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