New Concepts of Optimizing Unit Commitment and Economic Load Dispatch Costs in Large Scale Power Systems

Musse Mohamud Ahmed, Ismail Hassan and Norhamimi Hamdan
Fakulti Kejuruteraan Elektrik, Kolej Universiti Teknikal Kebangsaan Malaysia,
Karung Berkunci 1200, 75450 Ayer keroh Melaka.
e-mail: norhamimi@kutkm.edu.my

Abstract- Using suitable solution techniques to the Unit Commitment (UC) and Economic Load Dispatch (ELD) problems play major role on finding an optimal power scheduling in electrical power system. The UC and ELD problems are to decide when and which generating units to commit and decommit, in order to minimize the total fuel cost over specified period subject to a large number of difficult constraints. Lagrangian Relaxation (LR) has been widely used to solve UC and ELD. Recently Bundling method (BM) has appeared to be one of the best multipliers updated techniques for LR. This method has promising and the fastest convergence characteristics for UC and ELD problems. For that reason, this paper is to solve the UC and ELD problems via LR, BM and interior point method. This paper explores also the best possible way of updating Lagrangian multipliers with minimum computation time using fast programming techniques.

Keywords
Power System Operations, Unit Commitment, Economic Load Dispatch, Lagrangian Relaxation and Bundling Method.

I. INTRODUCTION

For the last two decades the Unit Commitment (UC) and Economic Load Dispatch (ELD) problems have attracted a great deal of attention from researchers and power system experts. The main problem needed is how the varying forecasted load could be met with optimum cost and feasible generators scheduling for thermal units [1,4]. As electricity cannot be stored, it is necessary to start-up and shutdown a number of generating units at various power stations each day. UC and ELD must satisfy all the constraints exist in the generation systems. The most important constraint is that the total generation must equal to the forecasted half-hourly, hourly, daily or weekly demands for electricity. Finding the best solution to UC and ELD is very important because it deals with the overall cost in power generation. Utility companies can obtain the maximum profit, only if the minimum total fuel costs have been achieved. This operating strategy is further used as the basis of determining economic and reserve based interchange transactions among generation stations. Other than that, computation simulation time for the scheduling program should be as fast as possible. This is because UC and ELD operate online. In this paper, UC and ELD problems will be discussed in section II. All the solution methods that can solve UC and ELD problems will be reviewed in section III. The focus for this paper will be more on Lagrangian Relaxation (LR) and Bundling Method (BM) as solving technique with interior point method (IPM) for multipliers initialization.

II. UNIT COMMITMENT AND ECONOMIC LOAD DISPATCH PROBLEMS

Unit Commitment (UC) is an operation scheduling function, which is sometimes called predispatch. In the overall hierarchy of generation resources management, the UC function fits between economic dispatch and maintenance and production scheduling [3]. To secure the operational requirements of a practical system, the commitment states (on/off) of hundreds of generating units should be provided for a time horizon from 24 hours to 168 hours. A large number of variables may be involved in this problem, while some parts of these variables are integers in nature. This commitment scheduling should maintain the balance between the generated megawatt (MW) power and the system demand under normal conditions. Moreover, sufficient MW spinning reserve should be available to account for the uncertainty of the demand and the generating unit failures. The actual power generation of each unit at every hour is calculated in the ELD process. The decision process selects units to be committed or decommitted, the type of fuel, the power generation of each unit and the reserve margin. Obtaining good schedules can considerably reduce the production costs, which is of increasing importance in the ongoing liberalization of the electricity market in many countries [5].

Economic load dispatch (ELD) is basically the process of apportioning the total load on a system between the various generating plants to achieve the greatest economy of operation [6]. The load demand required to meet varies in highly unpredictable fashion, and mostly nonlinear with the time. This scenario is making the whole problem very complex, requiring a

0-7803-8173-4/03/$17.00 ©2003 IEEE.