INTERNATIONAL RESEARCH JOURNAL IN ADVANCED ENGINEERING AND TECHNOLOGY (IRJAET) E - ISSN: 2454-4752 P - ISSN : 2454-4744
VOL 3 ISSUE 6 (2017) PAGES 2551 - 2555
RECEIVED : 15.11.2017 PUBLISHED : 19.12.2017
Dec 19, 2017

Long term hydro thermal scheduling for auto regressive stream flow models with parameter uncertainty

[1]Anakala Venkateswara Reddy, PG Scholar Power And Industrial Drives , Geethanajali College of Engineering and Technology.

[2]Muthyala Sridhar, Assistant Professor , Geethanajali College of Engineering and Technology.

[3]M.Mahammad Jabeer, HOD Dept of EEE, Geethanajali College of Engineering and Technology.

Abstract:
Optimal scheduling of power plant generation is the determination of the generation for every generating unit such that the total system generation cost is minimum while satisfying the system constraints [1]. All hydro-systems are unique in their characteristics. Different optimization methods have been applied to solve hydrothermal scheduling problems. This study reviews some of the common optimization methods and algorithms their strengths and weaknesses. The study found out that with time, old methods are improved upon and novel methods are developed to provide for more efficiency, faster convergence, robustness, and adaptability.

Keywords: Optimization, ALM, DE, FAPSO, EDDP, Hydrothermal.

1. INTRODUCTION

Natural differences in water areas, difference between release elements, control constraints, non-uniform water flow, sudden alterations in the volume of water flow due to seasonal or natural constraints, occurrence of flood, drought and other natural phenomenon are among factors that affect hydro scheduling. The objective of the hydrothermal scheduling problem is to determine the water releases from each reservoir of the hydro system at each stage such that the operation cost is minimized along the planning period. Hydrothermal scheduling of a power system is concerned with thermal unit commitment and dispatch, and the hourly generation of hydro units agrangian relaxation technique decomposes the problem into the scheduling of individual thermal units and the scheduling of individual watersheds, the disadvantage is that the dual solution is generally infeasible to generate a good feasible solution based on dual results. After the feasible solution is obtained, a few more high level iterations are carried out to obtain additional feasible solutions and the best feasible solution is selected. The final feasible cost and the maximum dual function value are used to calculate the dual gap, a measure of the quality of the feasible schedule.This method did not incorporate pumped-storage unit and cpu time was about four to five minutes. The problem was decomposed into a thermal subproblem and hydro subproblem. The thermal subproblem was solved analytically and the hydro subproblem was further decomposed into a set of smaller problems that can be solved in parallel.It was also used to handle unpredictable changes in natural flow presented a bundle trust region method (BTRM) to update multipliers within the Lagrangian relaxation framework. Lagrangian multipliers are usually updated by the subgradient method.

2. RELATED WORK

Inquired into an algorithm for dual variable updating, usingconcepts of trust region and subgradient algorithms in order to improve both dual optimality and planfeasibility. Comparing with a conventional subgradient algorithm the limitation of using the developed algorithm was: the need to have a small oscillation of the dual function in a neighborhood of the optimal point for the dual problem.

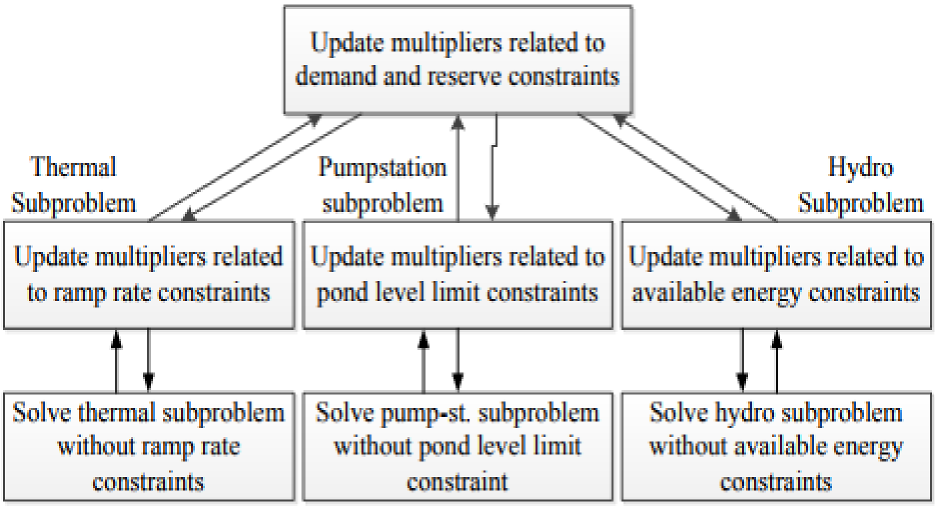

Fig.1.Basic Structure

The advantages of using the developed algorithm are: good adaptation of step sizes as opposed to trial and error tuning of the parameters in conventional subgradient algorithms. presented a two-stage stochastic programming model for the short or mid-term cost-optimal electric power production planning considering the power generation in a hydro-thermal generation system under uncertainty in demand (or load) and prices for fuel and delivery contracts.The algorithmic approach consisted of a stochastic version of the classical Lagrangian relaxation idea. The corresponding coupling constraints contained random variables, hence stochastic multipliers were needed for the dualization, and the dual problem represents a nondifferentiable stochastic program. Subsequently, the approach was based on the same, but stochastic, ingredients as in the classical case: a solver for the nondifferentiable dual, subproblem solvers, and a Lagrangian heuristics. It turns out that, due to the availability of a state-of-the- art bundle method for solving the dual, efficient stochastic subproblem solvers based on a specific descent algorithm and stochastic dynamic programming, respectively, and a specific Lagrangian heuristics for determining a nearly optimal primal solution, this stochastic Lagrangian relaxation algorithm becomes efficient.

3. PROPOSED SYSTEM

To validate the results obtained with the proposed ECA method, the same problem was solved using a genetic algorithm (GA) and differential evolution (DE). The problems were also solved using the augmented Lagrange method (ALM) and two phase neural network algorithm (TNN). Comparison of results showed that the porposed ECA method can find a lower thermal plant total cost and a faster computation time then the other methods, yields better results while satisfying various constraints. Convergence property of the ECA method is better than that of DE and GA for the solving short-term generation scheduling of hydrothermal systems. The main reason is that the ECA method has a belief space and it can utilize sufficiently the problem-based domain knowledge obtained during the evolutionary process to make the search process more efficient, while DE and GA are lacking this mechanism and thus make its search performance inferior to ECA. In the mid-term operation planning of the Brazilian in- terconnected system, there are about 100 hydro plants for which inflow scenarios must be generated. A stochastic model for the system should consider not only the inflow serial correlation but also the spatial dependency, in order to capture all inflow future possibilities with a small tree size. Due to time dependency, the realizations of the stochastic process must take into account the past inflows defined by the tree node under consideration. Stochastic streamflow models — such as a discrete time, monthly steps, multi-variate periodic autoregressive model (PAR) — can be used to represent seasonality, as well as serial and spatial inflow correlation intra and inter river basins, and thus build inflow scenarios. These scenarios are multivariate, with each component corresponding to a hydro plant. For a scenario tree to be representative it should include an expressive number of combinations among inflows to each site. Therefore the scenario tree is potentially very large. As mentioned in the previous section, the log transformation of the incremental streamflow to each gauge station was assumed to be in the Normal domain so that the stochastic process can be represented by a PAR(1) stochastic model. At each stage, the scenario inflows are selected conditioned to past inflows. Several approaches have been developed to decrease the size of a given scenario tree, as for instance, clustering procedures (using K-means algorithm, [5]) and the scenario reduction technique ([4]). The former is the standard in many applica- tions involving classification, while the latter was developed specifically for applications in a stochastic optimization con- text. It makes use of metric distances on spaces of probabilities measures, and selects a metric in such a way that the optimal values of original and approximate stochastic programs are close if the distance of the original probability distribution and its approximation is small. Both techniques were applied to a large independent and identically distributed (iid) random sample, resulting in a non equiprobable sub-sample of the multivariate distribution of the random vector $\xi(\omega)$.

4. ANALYSIS

Although the proposed stochastic streamflow generation model preserves, by construction, the conditioned monthly means and variances of the inflows, the selection of just a few of the principal components into account may affect the cross correlation structure. In order to evaluate this effect, shows the absolute cross correlations differences between the historical and those resulting from using only the 4 first principal components. One can observe a great similarity among these values in the vast majority of cases. Only about 30% of the cross correlations show differences greater than 0.1; 8% of these values are above 0.2 and 0.5% are above 0.4. These results indicate that taking only the first four principal components is sufficient to represent the spatial dependency of the inflows. The number of rows and columns of the stochastic hy- drothermal scheduling problem depends on the size of the scenario tree and on the dimension of the hydrothermal system. For multi-stage problems the size can be prohibitive, requiring special decomposition solution methods. The hydrothermal scheduling problem for this case study has 154000 variables and 782250 constraints, with 1617560 nonzero matrix ele- ments, but can be efficiently solved using an interior point method. In this work, we used the Xpress-Optimizer Barrier solver, [10]. The solution time on a 2.8 GHz P-IV with 1 Gb of memory was about 3 minutes. Table I presents the main results (total thermal generation and marginal costs) of the solution. In the first month, all load is supplied by the hydro plants; in months two and three, there is small thermal generation in the Southern area for a few scenarios. The Southern area is the only one with marginal cost different form zero in the first stage. Two thermal plants were dispatched in stage 2

INTERNATIONAL RESEARCH JOURNAL IN ADVANCED ENGINEERING AND TECHNOLOGY (IRJAET) E - ISSN: 2454-4752 P - ISSN : 2454-4744
VOL 3 ISSUE 6 (2017) PAGES 2551 - 2555
RECEIVED : 15.11.2017 PUBLISHED : 19.12.2017

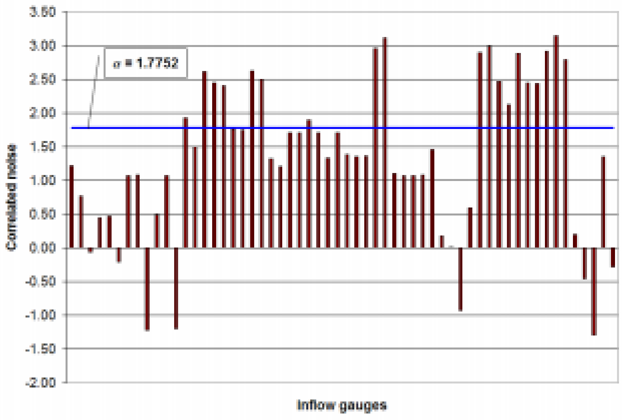

Fig.2.inflow Structure

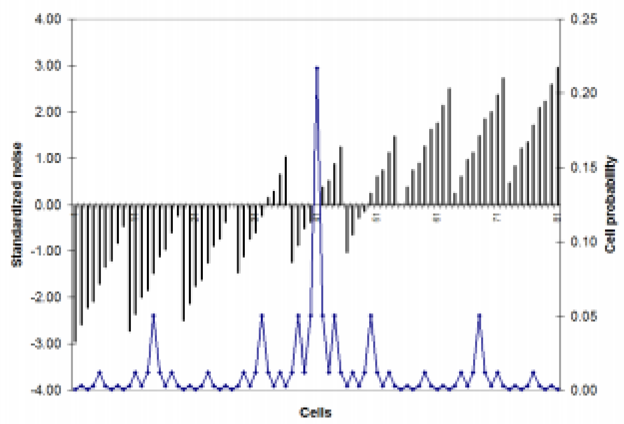

Fig.3.System Output

and six in stage 3 to meet the demand in the Southern region. The marginal costs refer to water value of the Southern region hydro plants. This is typical for the Brazilian hydropower system, in which average energy production is about 90% of hydro origin. The interconnection limits between the Southern.

CONCLUSION

the operating cost of thermal plant is very high, though their capital cost is low. On the other hand, the operating cost of hydroelectric plant is low, though their capital cost is high, so it has become economical as well as convenient to have both thermal and hydro plants in the same grid.The objective of optimal operation to hydrothermal power is usually to minimize the thermal cost function while satisfying physical and operational constraints All the techniques reviewed and methods presented claim to have faster convergence time and reduced CPU speed. After intensive reviewing, it is unsurprising that, certainly new efficient methods are developed continually to increase computation speed and achieve near ideal convergence for optimal schedule of hydrothermal systems.

REFERENCES

[1] K. S. Atul, "Short Term Hydrothermal Scheduling using Evolutionary Programming," Electrical & Instrumentation Engineering Department, Thapar University, Patiala, Master of Engineering Thesis in Power Systems & Electric Drives (Supervised by Mr. Nitin Narang) 2009. [2] X. Yuan, H. Nie, Y. Yuan, A. Su, and L. Wang, "Hydrothermal systems generation scheduling using cultural algorithm.," ournal of Hydroinformatics, vol. 11, no. 1, pp. 65-78, 2009.

[3] J. Grake and L. Kirchmayer, "Optimum operation of a hydrothermal system.," AIEE Trans., vol. PAS 80, pp. 242-250, 1962.

[4] M. Papageorgiou, "Optimum mult reservoir network control by the discrete maximum principle.," Water Resour. Res., vol. 21, no. 2, pp. 1824-1830, 1985.

[5] S. Solima and G. Christensen, "Application of functional analysis to optimization of variable head multi reservoir power system for long term regulation.," Water Resour. Res., vol. 22, no. 6, pp. 852-858, 1986.

[6] J. Yang and N. Chen, "Short-term hydrothermal coordination using multipass dynamic programming.," IEEE Transactions on Power Systems, vol. 4, no. 3, pp. 1050-1056, 1989.

[7] W. Yeh, "Optimization of real time hydrothermal system operation," J. Water Res. Plan. Manage., vol. 118, no. 6, pp. 636-653, 1992.

[8] J. Tang and P.B. Luh, "Hydrothermal Scheduling Via Extended Differential Dynamic Programmng and Mixed Coordination*," IEEE Transaction on Power Systems, vol. 10, no. 4, pp. 2021-2028, November 1995.