The authors of this paper introduce an approach to the hydrothermal scheduling problem using convexity issues. The focus of this study is the short-term hydrothermal scheduling problem which uses the water storage and release schedules from mid- and long-term results and modifies the problem to account for short-term rainfall, water inflow and load predictions. Because of the complexity and non-linear relationship of the problem, it is often solved using the Lagrangian relaxation technique. Solving this type of problem is computationally intensive; however, many software packages exist to solve specific problems proposed by specific water plants. The authors attempt to present a short-term hydrothermal algorithm that is compatible with off the shelf optimization solver programs (OSL, CPLEX, ZOOM, etc.) and that is affordable. The use of the before mentioned optimization solvers often require the problem to be convex and normally constrained. Moreover, the solvers can not solve a problem with conditional constraints. Thus, the problem is converted to a linear, mixed integer programming problem with unconditional, normal constraints. The convexity issue is essential for solving the relaxed linear programming problem using the Branch & Bound technique.

The formulation of the problem has an objective function that seeks to minimize total operating costs while utilizing seven decision variables and incorporating more than twenty constraints. There is significant interaction between the constraints which leads to the possible non-convexity within the problem. The authors attempt to restore convexity
to the problem with specific constraints designed to interact with other constraints using common variables.

The objective is to seek the optimal operating schedule of the thermal units while minimizing costs. The on/off status of the thermal and hydro units are modeled as binary decision variables equal to one or zero. Other model specific assumptions made by the authors were made. The water head loss was modeled as a function of the plant water spillage and the discharges from the hydro units (in an attempt to obtain convexity). Also, specific for this short-term scheduling problem, the average gross water head is calculated using the inflow predictions and the modified starting and ending water levels. The authors also model the run-of-river plants with water storage volumes set to zero. The functions are all linearized and the problem ready to be relaxed and solved.

The authors present a case study on a small problem with 13 thermal units and 16 hydro units. The scheduling problem is solved using the developed algorithm and the Branch & Bound technique. Other heuristics are identified if one is pressed for time to provide a quick solution; however, the authors only present data for the solutions obtained from the Branch & Bound. Their results demonstrate the algorithm’s efficiency and ability to obtain good results in a reasonable amount of time. I believe this study has significant merit in its development of the algorithm and possesses nobleness in its objective. Small budget power plants or developing countries now have the capability to utilize the authors’ model and algorithm to solve the short-term hydrothermal scheduling problem without having to pay consultant companies thousands of dollars.\(^1\)