

Nalan Laothumyingyong 2010: Security-Constrained Unit Commitment using Mixed-Integer Programming with Benders Decomposition. Master of Engineering (Electrical Engineering), Major Field: Electrical Engineering, Department of Electrical Engineering. Thesis Advisor: Assistant Professor Parnjit Damrongkulkamjorn, Ph.D. 72 pages.

The objective of this thesis is to determine the 24-hour unit commitment with minimum total generation cost subjecting to power flow constraints in both normal operating state and contingency state, which is considered the security-constrained unit commitment (SCUC). In this research, the Benders' Decomposition technique has been applied by decomposing the problem into two parts: the master problem; and the subproblems. The master problem which is the unit commitment problem contains integer variables as the on-off status of the generating units, and therefore could be solved as Mixed-Integer Programming problem. The branch-and-cut method has been chosen to solve the master mixed-integer problem. There are two subproblems using considered in this research: the power flow mismatch equations; and the operating limits of power systems. The first subproblem ensures that the committing units are able to serve loads locating all over the network through the connected transmission lines. The second subproblem takes into account the line flow and voltage limits of every line and every bus in the system. If the conditions in any subproblems are violated, the Benders Cuts corresponding to the violated constraints are added to the master problem in order to resolve the mixed-integer unit commitment problem. The proposed algorithm is tested on the IEEE 57-bus system with 7 thermal generating units. The 24-hour load data is made available along with the additional data for generating units. The results of typical unit commitment, security-constrained unit commitment under normal operating state and SCUC with contingency state are shown. The total generating costs of SCUC with contingency are higher than the others'. However the committed units of that SCUC ensure that the system could still serve load when contingency occurs.

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Thesis Advisor's signature