SOLVING UNIT COMMITMENT PROBLEM INCLUDING WIND POWER GENERATION USING PSS®E

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Abstract

Operating power systems in an optimal way and keeping it safe and reliable is very important in power systems' planning and operation. Therefore, power system operators try to supply electricity in an economic operation by turning on the cheapest generating units and dispatching off-line the most expensive ones at the off-peak value of a load. Unit commitment (UC) is one of the methods that utilities use to optimize the power system operation cost. Whereas, Economic dispatch (ED) is a subproblem that deal with finding the optimal output power from each committed unit. In other words, the main benefits of solving the unit commitment problem and economic dispatch are to minimize generation cost over the objective period horizon while applying all power system constraints that come from generating units' limits and the transmission system's characteristics, as well as to verify the balance between power generation and power demand.

On the other hand, the existing generation recourses (e.g. Hydro, Coal, Gas, nuclear, Oil, PV, Wind and others) is varying from place to place. This variation may influence the energy cost. The wind generation for example has a great impact on the economic operation of power system. It is available in abundance with no cost (except for maintenance). However, wind's intermittency and fluctuation form significant problems to

power systems.

In this thesis, we have solved the unit commitment, economic dispatch, and optimal power flow with the inclusion of a great amount of wind generation by using the Power System Simulator for Engineering (PSS®E). The constraints like voltage security, transformer and transmission lines limit, unit's ramping, and spinning reserve have all been satisfied in solving the unit commitment. The implementation is performed on two test power systems which are the IEEE 30-bus system and the 24-bus system. In addition, the implementation is based on 24-hour wind data forecasting and 24-hour power demand's prediction. In addition, the best locations to install a wind power plant for both systems have been investigated in this work. We have found that bus 5 and 8 are the best ties to install a 100 MW wind power plant to the IEEE 30-bus system without violating the system limits. In the same way for the 24-bus system, the best connection area of a 300MWwind plant is at bus 154.