Abstract:

The power system planning has been always an important topic through the power engineering literature history. The optimal expansion plan not only guarantees the system adequacy and eases the short-term operation, but also prevents the waste of financial resources. In this research study, the simultaneous planning of generation and transmission sub-systems has been reviewed in three phases. At the first stage, a new problem formulation has been presented which can specify the most economical plan under the required reliability considerations besides including some practical constraints especially in the transmission sub-system. At the second stage, this formulation has been extended from a static point of view to a dynamic one, under a linear framework so that it can be efficiently solved and the positive characteristics of the first stage model has been also kept. Finally at the third stage, the effect of load forecast uncertainty has been studied on the planning procedure based on a multi-objective optimization model. As a result of this stage, a practical tool has been developed for the planners that helps to deal with the planning uncertainties. The main contributions of this thesis rely on the mathematical model, reliability algorithms, and the developed robustness concept for investigating the planning uncertainties. The latter is so much important which can be used beside the most of the formerly established models in generation, transmission, and distribution expansion planning. The obtained results from this research show the necessity for the dynamic solution of the simultaneous generation and transmission expansion planning to avoid wasting of the monetary capitals. Moreover, the use of robustness concept is evaluated to be very beneficial for the uncertainty handling in the power system planning.

Iran University of Science and Technology

Electrical Engineering Department

Coordination of Generation and Transmission Expansion Planning under Reliability Requirements and Load Forecast Uncertainty

A Thesis Submitted in Partial Fulfillment of the Requirement for the Doctor of Philosophy Degree in the Power Systems Engineering

BY:
Behnam Alizadeh

Supervisor:
Dr. Shahram Jadid

June 2014