KING SAUD UNIVERSITY
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ADVANCED ANALYSIS AND OPERATION OF INTERCONNECTED POWER SYSTEMS

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Abstract

The on-going trend of unbundling power utility business, the introduction of de-regulation and the breakup of generation will have an impact upon the existing electric power business in Saudi Arabia and will influence the development of bilateral power markets involving the envisaged interconnection between Gulf Co-operation Council (GCC) states. Such competitive markets will influence the price and behavior of sources of electricity as well as the manner in which power pools in the interconnected region interact with each other. The development of generation and load centers is expected to occur where these competitive gains are the highest. A general look at the electricity situation in the region would suggest that the Saudi power grid has a significant opportunity to play a pivotal role in the electricity transaction with neighboring states.

The work of this thesis contributes to the evolution of the Gulf interconnected system by investigating and evaluating various interconnected system reliability and quality assessment measures as well as available fuel supply technologies. With the help of advanced simulation tools, which can handle the large-scale nature of the reliability and quality assessment problem normally associated with interconnected power system analysis, accurate determination of key reliability and quality planning indices could be carried out. As part of the present work, several illustrative case scenarios representing possible GCC interconnection operating scenarios were analyzed in terms of potential contingencies and system outages that may occur. In these case scenarios, various measures and indices representing impacts on system reliability and quality levels are evaluated at different values of the interconnected system design and operating parameters. Such sensitivity-based information is extremely useful in determining which parameters impact the most on the reliability and quality indices. The determination of such high-sensitivity parameters would allow subsequent mitigation of reliability and quality problems by focusing more on those more effective parameters related to system design and operation. An advanced simulation program was used to carryout the required computerized assessment of the reliability and quality levels associated with the Gulf interconnected system. The program uses a set of input parameter values representing the simulated status of the interconnected system as well as a set of pertinent decision variables to compute several output reliability and quality assessment indices.