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SURVEY PAPER ON SECURITY MECHANISM IN TRANSMISSION NETWORK WITH REMEDIAL CHECKS

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Abstract: Remedial checks operation techniques can be used to raise the flexibility, to maximize the the integration of new generators and to reduce the overall cost. As far as the uncertainties considered, the transmission network should be flexible and economically vigorous. The efficient levels of investment in network reinforcement can be determined by the growth in application of corrective actions to modify the network usage will require a probabilistic treatment of network. A new algorithm is proposed within the developed benders decomposition based investment model which can identify outages and filter out those outages which do not contribute to finding the optimum operating solution. A novel filtering technique is use for efficient elimination of redundant outages , presented and successfully tested. The same technique is used for selecting relevant contingencies.. In numerical examples we compare efficiency of network reinforcement propositions under both deterministic and probabilistic frameworks, while optimizing available preventive and corrective control actions, and in particular focusing on the application of generation reserve in combination with special protection schemes (SPS) for network congestion management purposes. We spotlight the deficiency of the deterministic approach with respect to its inherent inability to maximize correctly the portfolio of pre-fault post-fault actions since the impact of right actions (in the form of SPS, demand response) and occurrence of "non-credible" events require explicit consideration of the feasibility of various outages.

Keywords: corrective control, bandwidth utilization, network utilization

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INTRODUCTION

Securing a computer network infrastructure is a specialized field in a computer network. Network security is typically handled by a network administer who implements the policy, network and hardware needed to protect a network and the resources accessed through the network from unauthorized access and also ensure that employees have adequate access to the network and resources to work. This means that a well-implemented network security blocks viruses, malware, hackers, etc. from accessing or altering secure information.

We also know that, security provides authentication and access control for resources. Network security involves the authorization of access to data in a network. Users choose or are assigned an ID and password or other authenticating information that allows them access to information and programs within their authority. Network security has been historically based on deterministic criteria: electricity system should be able to withstand the occurrence of any defined set of credible outages without causing overloads or inadequate voltages on any remaining circuits, and without violating system stability limits. The underlying principle of the deterministic framework is that the system operation in a particular condition is considered to be exposed to no risk at all if the occurrence of any selected credible contingency does not violate the operational limits, while the system is considered to operate at an unacceptable level of risk if the occurrence of a credible contingency would cause some violations of operating limits. Neither of these is correct, as the system is indeed exposed to risks of failure and outages even if no credible network outage leads to violations of operating constraints and the risk of some violations may be acceptable if these can be minimized by using further post-fault corrective action. To tackle these problems, probabilistic frameworks for network security have been discussed and a number of novel approaches that assess risk profiles and balance security and economics have been proposed like that in [1].

The transmission expansion planning (TEP) problem in modern power systems is a large-scale, mixed-integer, non-linear and non-convex problem. TEP is a rather complicated process which requires extensive studies to determine when, where and how many transmission facilities are needed. A well planned power system will not only enhance the system reliability, but also tend to contribute positively to the overall system operating efficiency. Although remarkable advances have been made in optimization techniques, finding an optimal solution to a problem of this nature can still be extremely challenging. Based on the literalized power flow model and presents a mixed-integer linear programming (MILP) approach that considers losses, generator costs and the N - 1 security constraints for the multi-stage TEP problem [3]. Although the probabilistic framework is in principle superior, in practice its additional value with respect to the deterministic approach is particularly material in the presence of significant application of corrective control. This could include, for example, generation re-dispatch, topology re-configuration and use of flexible AC transmission systems (FACTS), use of special protection systems (SPS), and application of flexible demand. SPS have been widely used to increase the transfer capability of the network by assisting system operators in administering fast corrective actions. Compared with constructing new transmission facilities, SPS can be placed in service relatively quickly and inexpensively. However, increased reliance on SPS results in additional risks to system security.

Furthermore, the probabilistic framework is particularly relevant when exercising corrective actions that involve cost. These effects cannot be taken into account, sufficiently accurately, within a deterministic approach as the cost of exercising corrective actions need to be balanced against the associated pre-fault cost. We present a novel transmission network investment model within the probabilistic framework that optimally balances preventive and corrective controls while determining efficient transmission network reinforcements. Transmission switching (TS) is introduced to add flexibility to the transmission and generation capacity expansion planning problem. TS could improve the performance of the capacity expansion planning model and reduce the total planning cost. The capacity expansion planning problem is decomposed into a master problem and two sub problems as presented in [5].

The master problem utilizes the candidate set for additional generating unit and transmission capacity investments to find the optimal plan throughout the planning horizon. The sub problems use the optimal plan, apply transmission switching to relieve any transmission flow violations, and calculate the optimal dispatch of generating units. The transmission network contingencies are also considered in the sub problems. The case studies exhibit the effectiveness of the proposed expansion planning approach.

Specifically, the presented model couples network operation and investment by means of a Benders algorithm, but rather than using a deterministic security constrained optimum power flow (SC-OPF) method to assess the effect of operational preventive and corrective control on network investment our model considers the probabilistic realization of a set of outages and permits balancing a larger portfolio of pre and post-fault operational actions such as network congestion, pre-fault commitment of generation reserve, post-fault generation re-dispatch or reserve utilization, and SPS over demand and generation. It is important to mention that current probabilistic models that are able to determine network investment have a limited consideration of the impact of corrective control on network investment as presented by [1, 2].

Also, network reinforcements are undertaken by examining an array of system operating conditions (demand levels) and operating states (i.e., outages of generation and transmission components) taking into account effects of weather conditions. In addition, a novel contingencies-selection or filtering technique that is able to interact with the primary Benders algorithm, is proposed to select relevant contingent events as the optimization is not limited to the occurrence of pre-defined outages only.

II. Description of Benders Algorithm

Benders decomposition is a solution method for solving certain large-scale optimization problems. Instead of considering all decision variables and constraints of a large-scale problem simultaneously, Benders decomposition partitions the problem into multiple smaller problems. The main idea is the is to add one cut per realization of uncertainty of the master problem in each iteration, that is, a many Benders cuts as the number of scenarios added to the master problem in each iteration

In Benders Algorithm, the network investment model plan the optimization model that give thought to various pre-fault operational measures and post-fault corrective actions to support operation and investment. The model is combination of operational, investment and filtering modules presented in following figure.

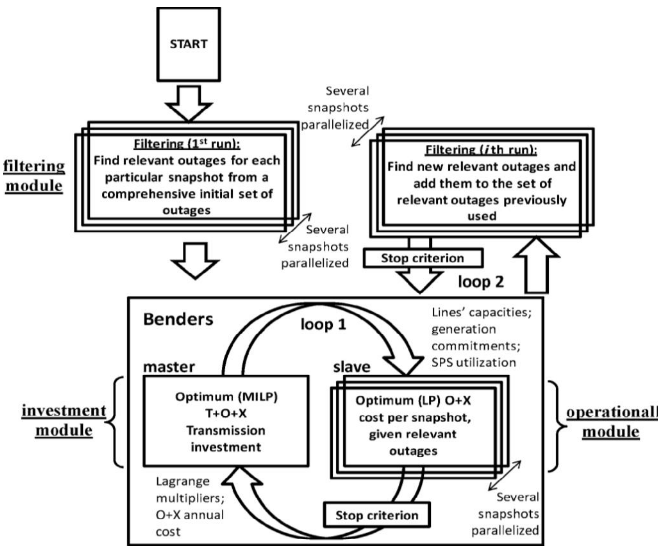

Figure.1 General Bender algorithm with 3 modules

1. Operational Module

In the operational module, the maximum probabilistic dispatch and so the maximum network utilization over a given operating condition is find out when considering the use of corrective control. The module find out the optimum power transfers across transmission network by balancing the cost of transmission hurdles against the cost of applying pre-fault operational measures and post-fault corrective actions. The optimization can be done under single Operating condition under a set of outages that are slant according to their properties, depend on whether. The benefits of the probabilistic framework are the pre-fault operational measures and post-fault corrective actions.

1). System balancing- Power flows can be controlled via generation balancing actions in order to mitigate circuit overloading while maintaining the supply and demand balance at all times.

2). Allocation and utilization of generation reserve- Different levels of generation reserve can be allocated in the pre-fault condition (via balancing actions) to efficiently deal with outage events in a post-fault condition. In this model, generation reserves are allocated and utilized in order to deal with outages not only of generating plants but also of transmission circuits. Consequently, the reserve is spatially optimized to facilitate the application of SPS. The reserve can be provided by synchronized generators and/or through units providing standing reserve of appropriate dynamic characteristics.

3). Exercise of SPS to curtail generation and/or demand- Following an outage of a circuit, SPS automatically disconnects (or instigate rapid reduction of) generation and demand in exporting and importing areas respectively, to avoid post-fault network overloads. This allows increased levels of power transfers in the pre-fault condition and hence results in reduced levels of network constraints.

2. Investment Module

The investment module supported by multiple executions of the operational module over a variety of operating conditions, determines:

1) The optimum network investment in a year,

2) The optimum generation commitments in each operating condition, and

3) The utilization of SPS in each operating state.

In investment timescales, the operating costs and risks associated with proposed transmission network reinforcement are measured and summed over the entire year which is represented by a set of operating conditions. This is required to determine the efficient levels of transmission investment that is balanced against the cost associated with pre-fault operational measures and post-fault corrective actions.

3. Filtering Module

The filtering module serves to limit the number of operating states considered in the optimization and is applied iteratively as follows:

1) Finding the relevant outages over the initial network for each operating condition (1st run in Fig.1),

2) Finding the relevant outages over the enhanced network for each operating condition, and adding these outages (if not included) to the previously found set of relevant outages (ith run in Fig.1).

The Benders algorithm (loop 1) stops according to the general criterion which is when the upper (Z upper) and lower (Z lower) estimations of the overall transmission cost function (i.e., investment (T) operation (O) unsupplied demand (X)) are nearly equal. Loop 2 stops if there are no more outages to be added to the set of relevant outages given the latest sets of transmission network capacities and generation outputs. To reduce the potentially substantial computational burden in larger networks, parallel threading is used (Fig.1 shows how different operating conditions can be run in parallel) together with a heuristic procedure that searches the (nearly) optimum solution of the mixed integer linear programming (MILP) problem within a given duality gap.

III. Routing Over Channel

Routing is the process of selecting best paths in a network. In packet switching networks, routing directs packet forwarding through intermediate nodes. Routing regions are typically rectangular and are classified on the basis of number of sides that have terminals of nets to be routed. A two-sided routing region is called a channel and the associated routing problem is called a channel routing problem. The network layer is responsible for routing packets from the source to destination. To overcome the various problems occurred in networking we have to use the different kinds of routing algorithm such that link state routing algorithm (Dijkstra's algorithm, Open Shortest Path First) or distance vector routing (Routing Information Protocol, Border Gateway Protocol).

IV. Security and Corrective Controls

To protect the network from various security threats, we have used the security mechanism and security services. Security controls are technical or administrative safeguards or counter measures to avoid, counteract or minimize loss or unavailability due to threats acting on their matching vulnerability, i.e., security risk. Controls are referenced all the time in security.

V. NETWORK UTILIZATION

Network utilization is the ratio of current network traffic to the maximum traffic that the port can handle. Through monitoring network utilization, we can understand whether the network is busy, normal or idle. Capsa Network Analyzer makes it easy for us to monitor the network utilization, so as to find out the bottleneck and improve network performance.

VI. CONCLUSION

The transmission network investment problem optimally balances preventive and corrective control within a probabilistic security model. Hence it is used as a benchmark to assess the performance characteristics of the conventional deterministic concept. We highlighted the inadequacies of the deterministic approach with respect to its inherent inability to optimize accurately the portfolio of pre-fault and post-fault actions since the impacts of corrective and occurrence of "non-credible" events require explicit consideration of the likelihood of various outages. In this paper, we concluded that deterministic approach drives less efficient and potentially more risky system operation that ultimately leads to inefficient network investment.

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