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A RELIABILITY-BASED DESIGN OPTIMIZATION MODEL FOR ELECTRICITY POWER NETWORKS

Ghasem Ezzati

g.ezzati@federation.edu.au
IEEE Student Member, Faculty of Science and Technology
Federation University Australia, Victoria, Australia

Abstract. Significant attentions have recently been attracted by electricity power networks where many optimization models are applied to optimize distributed power. Many optimization models are available for electricity networks that mainly take into account total cost. Reliability related issues of electricity networks are also considered in the literature. However, there is a lack to formulate a reliability-based design optimization (RBDO) model of these networks. An RBDO model is introduced in this paper to deal with probabilistic constraints in an optimization model for electricity networks. In our suggested approach, an optimization problem is firstly solved to find optimal parameters of the network. Then, the optimal solution is adjusted using an RBDO problem. Our main aim is to minimize an extra cost that is experienced by considering reliability. It is expected to have a higher extra cost for a lower failure probability.

Keywords. Probabilistic Constraints, Reliability Analysis, Reliability-Based Design Optimization, Electricity Power Networks

1 Introduction

Electricity network is one of the most complex systems ever known. There are many optimization models of electricity power networks. These models include mono- and multi-objective optimization problems (Carrano 2006; Farhoodnea 2012; Ganguly 2011; Khodr 2009; Merril 1991).

Reducing electricity losses in power networks is an important issue in electrical energy management. Cost of electricity is reduced and also efficiency of network is improved by reducing electricity losses (Evmorfopoulos 2004; Fourie 2004).

These losses are typically categorized as technical losses (such as losses due to physical aspect) and non-technical losses (such as unauthorized line tapping or meter bypassing). Endured cost of technical losses is often less than endured cost of non-technical losses (Davidson 2002; Khodr 2001).

In general, different items are considered for minimization in electricity networks' optimization models. Total cost, network area and voltage drops