



Alexandria University
Alexandria Engineering Journal

www.elsevier.com/locate/aej
www.sciencedirect.com



ORIGINAL ARTICLE

Composite power system reliability evaluation using modified minimal cut set approach

T. Bharath Kumar^{*}, O. Chandra Sekhar, M. Ramamoorthy

Department of Electrical and Electronics Engineering, K L University, India

Received 22 February 2017; accepted 23 September 2017

KEYWORDS

Minimal cut set;
 Composite power system;
 Classical node elimination

Abstract The composite power system reliability analysis is generally based on minimal path or cut enumeration, tracing of power flow paths from which the related reliability indices are calculated. The minimal cut set is a popular method in the reliability analysis for simple and complex configurations. Average availability of power supply at the consumer end is one of the reliability assessment parameter. This paper is concerned about the evaluation of this reliability index. A step by step procedure for a modified minimal cut set method is explained in this paper using IEEE 6 bus, 14 bus and Single area IEEE RTS 96 system. The proposed algorithm is easy to program and can be applicable to any system. The proposed algorithm is validated with the Classical Node Elimination method, Step by Step algorithm using Conditional Probability and Monte Carlo Simulation method. The proposed technique is tested with a practical example taken from Roy Billinton paper (Reliability evaluation in distribution and transmission systems).

© 2017 Faculty of Engineering, Alexandria University. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

The role of the modern power system is to satisfy the load as economically as possible, and with some reasonable level of continuity and quality. There are several methods available for the calculation of average power availability, which is one of the important reliability indices [1–8]. Some of the popular methods used are Minimal cut set, Series- Parallel, Star-Delta, Tracing of Power flow paths, Node Elimination method and step by step algorithm using conditional probability. The

modified minimal cut-set approach is proposed in this paper is an improvement over the method reported in [9]. In [9], all the branches included in each cut set of order 1 and also are assumed to be in parallel. Assuming that the sending end of each branch in the cut set has the same probability of availabilities and which is not correct. In the proposed method has this assumption is not used. The procedure adapted is explained in the following sections. The initial step in the cut-set method is to figure out the minimal cut-sets of the system. The identification of minimal cuts becomes more difficult in large complex systems. Some algorithms like Node Elimination method are developed further to reduce this effort for identification.

One of the objectives used for the evaluation of composite power system reliability is power availability at load buses [10–13]. Some assumptions made in the proposed algorithm are given below.

^{*} Corresponding author.

E-mail addresses: tbkumar256@gmail.com (T.B. Kumar), sekhar.obbu@gmail.com (O.C. Sekhar), mrmooorthy@gmail.com (M. Ramamoorthy).

Peer review under responsibility of Faculty of Engineering, Alexandria University.

<https://doi.org/10.1016/j.aej.2017.09.008>

1110-0168 © 2017 Faculty of Engineering, Alexandria University. Production and hosting by Elsevier B.V.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).