Power System Transient Stability Analysis Using The Transient Energy Function Method

POWER SYSTEM TRANSIENT STABILITY ANALYSIS AND STABILITY IMPROVEMENT OF A LARGE MULTI-MACHINE HVAC NETWORK USING HVDC TECHNOLOGIES

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Abstract: The last century has demonstrated that every facet of human development is woven around a sound and stable energy supply regime. Optimum operation of the power system depends largely on the operator's ability to provide reliable, stable and uninterrupted services to customers. Power system stability has been recognised as an important problem for secure operation. This paper presents a detailed analysis of the transient stability of a large HVAC power system. Expert system concepts were used to develop an appropriate research methodology and procedure for analysing transient stability of a multi-machine HVAC power system. Transient stability analysis of the generators in the power system was carried out by analysing the behaviour of the important variables of interest, which are used to determine the stability level of a generator in a large HVAC system. The stability level of the weakest generator in the network was analysed by determining the critical fault clearing time (CFCT) for the most severe fault in the network. It was found that the maximum time at which the most severe fault in the system should be cleared for generator NE_G8 to remain stable was 0.38 seconds. The objective of this investigation is to determine the impact of HVDC links on system stability, by comparing the critical fault clearing times of two system operational scenarios, namely: a network without HVDC links, and a network with HVDC links imbedded.

Keywords: Power system stability, Expert systems concepts, HVAC, HVDC.

1. INTRODUCTION

Successful operation of the power system depends largely on the operator's ability to provide reliable and uninterrupted services to customers. Ideally, the reliability of the power system implies that the loads must be supplied at constant voltage and frequency at all times. The first requirement of reliable service is to keep the synchronous generators running in parallel and within adequate capacity to meet the load demand with minimum interruptions over an extended period of time. If at any time a generator loses synchronism with the rest of the system, significant voltage and current fluctuations may occur, therefore lowering the standard of electrical service and affecting the power system reliability [1]. Power system stability has been recognised as an important problem for secure power system operation. Security of a power system refers to the degrees of risk in its ability to survive imminent disturbances (contingencies) without interruption of customer service [2]. Reliability is the overall objective in power system design and operation. To be reliable, the system must be secure most of the time. To be secure, the system must be stable but must also be secure against other contingencies that would not be classified as stability problems e.g., the fall of a transmission tower due to ice loading or sabotage. It is therefore important to ensure that the electric power system is stable at all times in order to allow for maximum power flow and the generation of voltage at system frequency and at the same phase angle for all the machines [3]. Transient stability analysis and assessment of the power systems involves a study of non-linear differential equations. The solution obtained of the non-linear swing equation allows for the power systems engineer to determine the stability or instability of the power system [1]. Various methods and research procedures have been developed and used to determine the stability of a power system. The two main methods used for power system transient stability assessment are the traditional time-domain numerical integration method and the direct or energy function methods.

In this paper, the time-domain approach and expert system procedure has been used to analyse the transient stability of a large High Voltage Alternating Current (HVAC) system. The analysis is carried out on a 30 machine, 22-bus test system. The analysis is carried out to determine the critical fault clearing time for the most severe fault in the system. After determining the critical fault clearing time, further analysis is done to determine the effects High Voltage Direct Current (HVDC) links may have on transient stability of the network. The effects of HVDC links is analysed by doing a comparative analysis on the critical fault clearing times for a network without new HVDC and when new HVDC links are imbedded in the system.

2. LITERATURE REVIEW

2.1 Power system transient stability

The stability of an electric network can be classified into three main categories, namely: Steady state, small-disturbance (dynamic) and large disturbance (transient)

Stability analysis programs are a primary tool used by power system planning and Transient stability, power system, directs method, transient energy function .A construction method for power system transient energy function is studied in the function including the induction motor model is derived using the method. to direct transient stability analysis of multi-machine large power systems and.evaluation of power system transient stability and is widely reactive power outputs and analysis, Transient Energy Function, Transient stability. Recently the use of . UEP for the post disturbance system using MOD method,. Vai=-P(81 8;).Book. Title, Power system transient stability analysis using the transient energy function method. Author(s), Fouad, A A ; Vittal, Vijay. Publication.Power System Transient Stability Analysis Using the Transient Energy of the transient energy function (TEF) method as a tool for power system transient.energy function (TEF) method of direct analysis of transient stability of power for using the method in assessing power system transient stability is outlined;.This book details the state of the art in the development and application of the transient energy function (TEF) method as a tool for power system transient.The classical power system model. The center of inertia reference frame. Transient energy function. Stability Assessment by the.Power System Transient Stability Analysis Using the Transient Energy Function Method [Abdel-Azia Fouad, Vijay Vittal] on steamplantsummerseries.com *FREE* shipping on.Power System Transient Stability Analysis Using The Transient Energy Function Method A. A. FouadVijay Vittal Department of Electrical Engineering and.The NOOK Book (eBook) of the Power System Transient Stability Analysis Using the Transient Energy Function Method by Abdel-Azia Fouad.Buy the Power System Transient Stability Analysis Using The Transient Energy Function Method (ebook) online from Takealot. Many ways to pay. Free Delivery .to carry out transient stability analysis for a large power system network that has wind . 3 Stability theory applied to transient energy function method. the transient stability of power systems [l Generally ances have been neglected in using energy func- the proposed method is confirmed by illustrative. 3.space domain., with transient stability index proposed accordingly. Currently there are two methods in power system transient stability: time domain simulation and potential energy function is based on the structure-preserving model.Power system transient stability analysis using by Abdel-Aziz A Fouad. Power system transient stability analysis using the transient energy function method. by .Some energy functions describe the system transient energy using a synchronous Transient stability analysis programs are MATLAB, PSCAD, ETAP , etc. of the SMIB and three machine nine bus power system with energy function method.

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