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The Efficient Search Method for High Risk Events of Power Systems Resulted

from the Loss of Transient Stability Caused by Natural Disasters

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Power systems become large and complex, so the occurrence rates of a great deal of energy loss caused by faults become high. In this situation, the development of the efficient search method for high risk events of power systems is strongly required. Risk is defined as the product of energy loss and its occurrence rate. This paper presents the developed method which can search accurately and efficiently high risk events of power systems resulted from the loss of transient stability caused by natural disasters.

The outline of this method is shown as follows.
(1) Generating probability density functions of loads
(2) Selecting representative natural disasters
(3) Setting up natural disaster to be assessed next
(4) Generating event tree from natural disasters to groups of faults
(5) Selecting representative groups of faults caused by natural disaster
(6) Setting up representative group of faults to be assessed next
(7) Generating event tree from group of faults to bottom events
(8) Selecting representative events
(9) Setting up representative event to be assessed next
(10) Calculating risk data in similar load change patterns 1) Generating critical fault clearing time function Y(X) [X : load, Y : critical fault clearing time] based on simulation results of transient phenomena 2) Generating discrete risk function by using occurrence rate of fault, probability density function of load, and critical fault clearing time function 3) Calculating risk data by integrating discrete risk function from bottom to top values of each discrete load width
(11) Calculating risk data in non-similar load change patterns by using average energy loss
(12) Identifying high risk events by sorting risk data according to values

The developed method was applied to a model power system with 3 generators. The results of application have clarified the following facts.
(1) The developed method can search accurately and efficiently high risk events of power systems caused by natural disasters.
(2) High risk events of power systems are caused by natural disasters which cause groups of severe faults with high frequency.

In order to apply it to real power systems, it will be applied to various power systems with many generators and will be improved by results of assessment.