iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 3 **Issue:** IV **Month of publication:** April 2015

DOI:

www.ijraset.com

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Volume 3 Issue IV, April 2015
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

A Review on Power System Security

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Abstract:-The purpose of this paper is to provide the real information about the power system security to maintain continuity of supply which prevents complex failure of power system and overall blackout.

I.INTRODUCTION

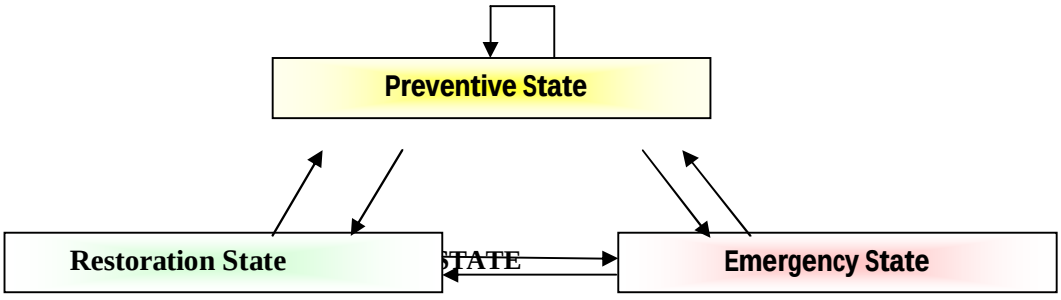
Today power sector is the one of the fastest growing sector, the overall country development depends upon the continuity of power supply and loss of power even for a several minutes can retard its development. Power cuts are common, but the power system with complete loss of synchronism leads to overall blackout or failures of grid. The blackout on July 2012 was the India's largest blackout. First, the Northern region grid failed and restored with the help of Bhutan's hydroelectric power followed by power supply from eastern and western grid within 19 hours. But, after sometime the Northern region grid failed again for the second time. This time due to sudden power interruption resulted in failure of two more regional grids namely, the Eastern and the North-Eastern Grids which supply India's 20 states. Then by late evening, half of the power was restored with the help of western and southern grids. Finally, northern region hydropower station started working and supply has been brought back up to Punjab and Haryana. The main cause behind such a large power disturbance. Each regional grid itself acts as a big system operates at a constant frequency and having constant flow of energy which balances the load. During minor problems load is re-balanced and sometimes the excess loads are balanced with the help of load shedding.
The problems above discussed can be minimized by the use of proper power security system.

II. POWER SYSTEM SECURITY

Power system security deals with the probability of a system to remain in prescribed limit and probability of system change with its environment is known as contingency. In other words, Power system must operate in normal range even when contingencies occur within the system. Its main aim to maintain supply continuity to prevent complete loss of synchronism of system or overall blackout.

III. STATES OF CONTENGENCIES

There are three states of contingencies namely:-



A. Preventive State

In other words, the preventive state is also known as Normal State .The word preventive is used for the security aspects. In this state, all the equipment's of power system are in prescribed limit and variables of system are in appropriate range.

Power system must be synchronized even in the case of credible contingency. Appropriate, Necessary and Preventive step must be required by the operator to maintain transcendence and integrity of power supply. Proper operator decision in preventive state prevents system from huge power loss.

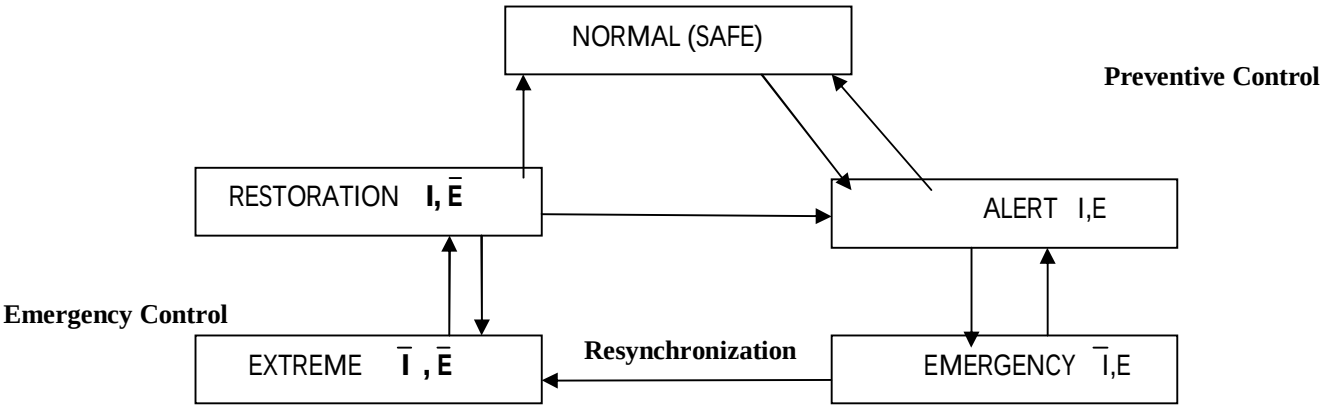
B. Emergency State

When the operating point of some power system components are deviated or when frequency of a system is decreasing then a power system goes to emergency state. Hence, the corrective action is immediately required to heal the system from huge stress without economic consideration.

C. Restoration State

At this state, the power of some major power system components or whole power of system has lost. Hence, the regulating step becomes necessary to bring back the system into its normal state.

IV. STATE TRANSITION DIAGRAM



E = Equality constraints
I = Inequality constraints
¯ = Bar (violation)

The analysis of complete power system is a complex task. So, its analysis can be done by using three sets of generic equation .Among 3, one of them is differential equation and rest of two is algebraic equation. The algebraic equations have constraint (E) which maintains the balance between demanded load and generation. And the other equation has inequality constraint (I) which ensures all power system components and states are in prescribed limit. If the generation of a power system decreases below the certain threshold .System reaches to alert state keeping constraints I &E maintained but proper action is required to bring system into safe mode. But if proper action is failed, the system reaches to emergency state.

V. COMPONENTS OF SECURITY ASSESSMENT

The components of security assessment are:-

A. System Monitoring

The assessment of the system in proper way requires the knowledge of system state. The devices like measurement equipments, circuit breakers provide the data which is further analyzed with the help of state estimators. Now with the of HMI (Human Machine Interfacing)and SCADA(Supervisory Control and Data Acquisition) remote switching has become possible.

B. Contingency

The contingency can be analyzed in following steps:-

1) *Definition*
2) *Selection*
3) *Evaluation*

First, the definition of contingency is must. Then the proper list of contingencies is required related to problem associated. Then the risk associated with the contingency can be analyzed by proper evaluation technique.

C. Preventive steps

Then immediate, proper and corrective steps are required to ensure that system is always in safe limit to maintain integrity of the power system.

VI. SUMMARY

The main aim of power system security is to limit the discontinuity of power supply, by the proper corrective action it can be done. It's a section of power system which prevents power system Grids from overall blackout.

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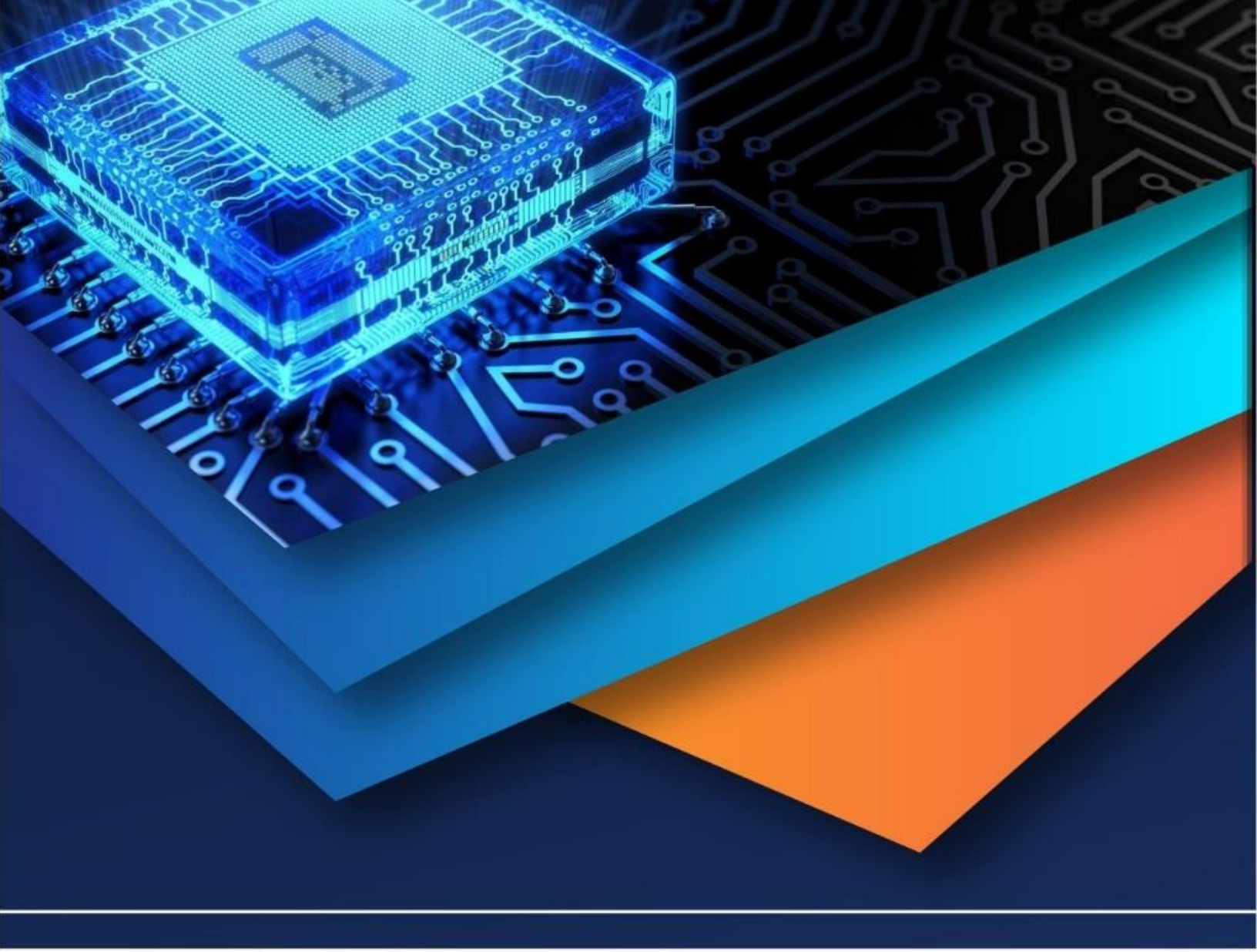

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