CONTINGENCY CONSTRAINED TRANSMISSION CONGESTION MANAGEMENT

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Abstract: Contingency analysis studies are very important from the operating and planning point of view. Abnormal condition can arise in a power system owing to transmission line or generator outage. Online steady state security analysis of power system requires evaluation of the effect of large number contingencies in order to access the security of the system. Contingency analysis is an important function which considered to be an integral part of the modern energy management system at energy control centers. The effect of single outage causes change in the bus voltage system, so that it is necessary to solve this problem with a contingency analysis simulation programmed for finding the solution of single outage problem. The result of contingency analysis allows system to be operated defensively. Many of the problems that occur on a power system can cause serious trouble within such a quick time period that the operator could not take action fast enough. This is often the case with cascading failures. Because of this aspect of systems operation, modem operations computers are equipped with contingency analysis programs that model possible systems troubles before they arise.
Index Terms: Introduction, OPF, contingency, Simulation Results, Conclusion& future work.

I. INTRODUCTION

Contingency analysis consists of a digital programme which simulates an existing power system and predicts bus voltage magnitudes and line currents for a possible generator or a transmission line tripping. This information enables the EMS manager to establish whether the system can be operated safely, following a particular generator or a transmission line tripping .Thus, contingency analysis ensure that no single contingency will result in overload or limit violations of voltage magnitude, thereby. guaranteeing a secure power system. Line and Generator outages may result in line flow and Bus. CA is performed on the SE network model to determine whether steady-state operating limits would be violated by the occurrence of credible contingencies. CA generally consists of two parts: contingency selection and contingency evaluation. The number of potential contingencies at any moment .in a large-scale power system is very large and the time window for system operators to analyze trouble spots and take appropriate preventive (pre contingency) and corrective (post contingency) actions is quite limited. Ideally, an ac power flow solution should be computed for each contingency case, but this would take far too long. Using a shortcut, CA could limit ac power flow solutions to a relatively small number of predefined contingencies that have been determined to be the most likely to cause violations. Because of its speed, almost all CA algorithms now use the fast decoupled power flow (FDPF) algorithm to obtain complete and accurate solutions of contingency cases . The earliest, and still widely used, method of CA employs line outage distribution factors (LODFs) to determine the effects of contingent line outages. The LODFs for a specified contingent line outage are the incremental real power flow in monitored lines caused by the outage of contingent line with a pre outage active power flow of me unit. Thus the incremental flows in all monitored lines caused by the outage of a contingent line with any given pre outage flow can be computed very rapidly from the contingent line LODFs. A contingency is the loss or failure of a small part of the power system (e.g. a transmission line), or the loss/failure of individual equipment.

II. OPTIMAL POWER FLOW

Now a days power system is restructured and interconnected .in a competitive market the cost of power decrease but the customer demand about reliable power increase. One of the major objectives of companies is to provide reliable power at lower cost [2]. Optimum power flow optimize a given objective with controlling the power flow within a network without violating ant constraints of power flow[2]. The power system problem using OPF only focuses the cost or any other objective function.

Objective function: To minimize the generation cost

$$\min \sum_{i=1}^{NG} F_i(P_{g_i}) = \sum_{i=1}^{NG} a_i P_{g_i}{}^2 + b_i P_{g_i} + c_i \ldots.(1)$$

Where

Fi(pgi)= cost of real power generation at generation i

a,b,c=cost coefficients at generator I

n=no. of generators

In equality constraints:

Line MVA limit

Bus voltage magnitude

Generator real power output

Equality constraints:

The equality constraints consists of power flow solution G(x,u)=Pi=Pd+Pl

Where

Pi =real power generation

Pd =total real power load

Pl=real power losses

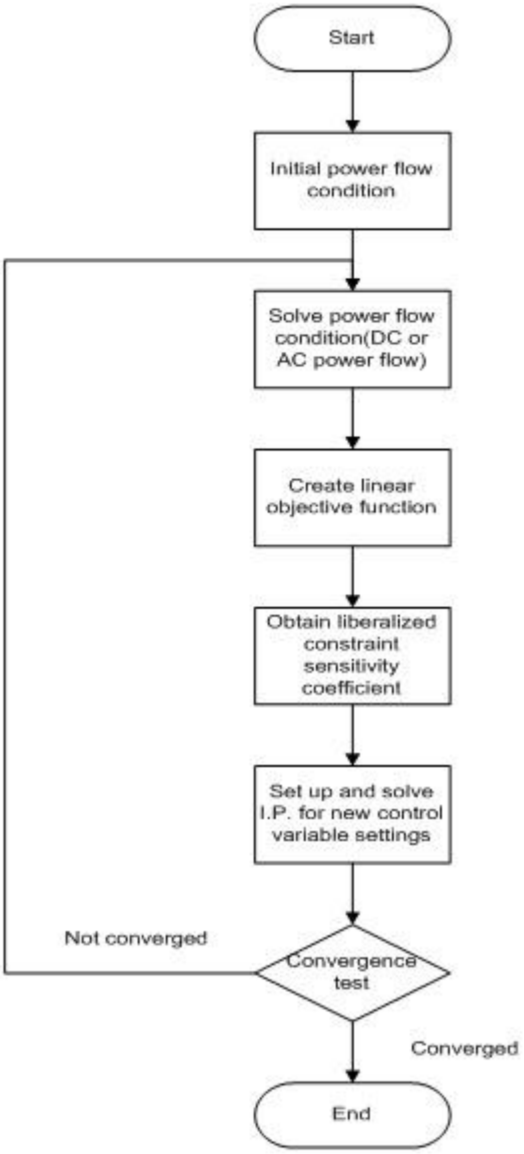

Fig: 1 flow chart for OPF using linear programming

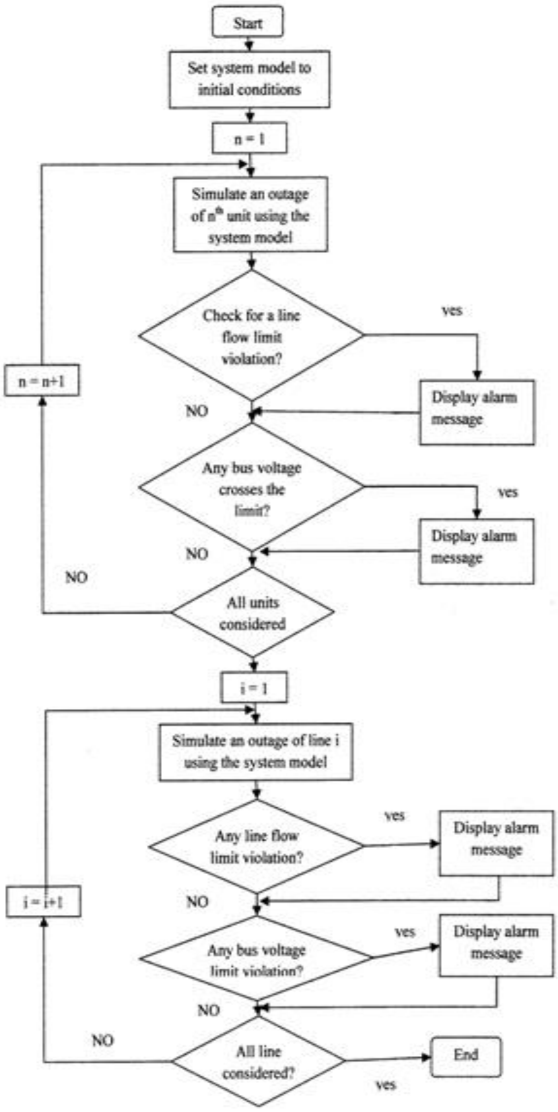

Fig: 2 flow chart of contingency analysis

III. CONTINGENCY ANALYSIS

Transmission lines, transformers, generators and buses are the key components of power system network. Different kind of contingencies that can happen based on these important components are discussed in this section. Due to physical vulnerability of a transmission line, it is most prone to the outages due to various reasons starting from sagging on to a tree to higher current flowing through it. The desired voltage level is maintained using the transformers which step up / down the voltage according to the requirements. A transformer outage is also one of the important outages in the system. During contingency analysis, transformers are generally considered as the transmission line outage with consideration of resistance and susceptance. It is very important to know the transformers and their functionalities when the load changes in the system, since they are responsible for the voltage profile in the network[11].'

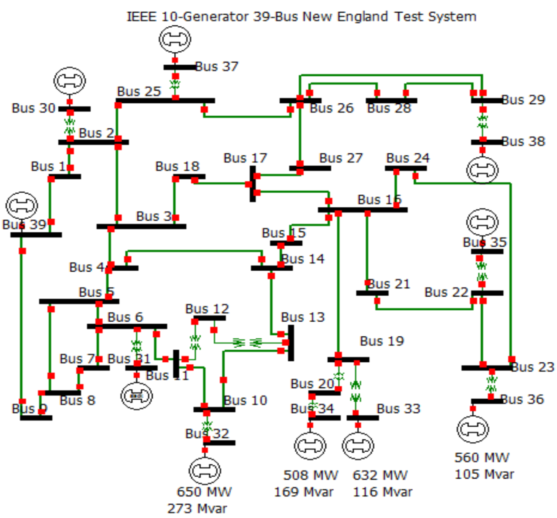

Fig: 3 simulation circuit of IEEE 39 bus

Measured Quantity	Load Flow	OPF
Total Generation(MW)	6141.77	6133.4
Total :Load(MW)	6097.10	6097.10
Total Loss(MW)	44.67	36.3
Cost($/h)	-	42827.83

Measured Quantity	Contingency After outage of line 29-38 & gen 38	SCOPF
Total Generation(MW)	6158.5	6156.1
Total :Load(MW)	6097.10	6097.10
Total Loss(MW)	61.4	59
Cost($/h)	52911.73	46248.11

IV. CONCLUSION

After performing contingency analysis on the system the transmission lines becomes overloaded as the line losses increases due to increase in line flow, also the violation of bus voltage occurs. So that power system becomes congested. To overcome this problem, Security Constrained Optimum Power Flow (SCOPF) is performed as a method of generation rescheduling and transmission congestion can be removed

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