Study of Congestion Due To Contingency in 9-Bus Test System

V.L Surya Prabha[1], B Prashanth [2], Shaik Mateen[3], MD Kamran Shams[4], MD Shahzoor[5]

[1]Assistant Professor, Dept of EEE, Lords Institute of Eng.& Tech.,JNTUH, Hyderabad,Telangana, India
[2] Student, Dept of EEE, Lords Institute of Eng.& Tech., JNTUH, Hyderabad, Telangana, India
[3] Student, Dept of EEE, Lords Institute of Eng.& Tech., JNTUH, Hyderabad, Telangana, India
[4] Student, Dept of EEE, Lords Institute of Eng.& Tech., JNTUH, Hyderabad, Telangana, India
[5] Student, Dept of EEE, Lords Institute of Eng.& Tech., JNTUH, Hyderabad, Telangana, India

Abstract - *The objective of operating power system is continuous operation with no discontinuity in power supply contingency Analysis of a power system is a major activity in power system planning and operation. In general an outage of one transmission line or transformer may lead to over loads in other branches and/or sudden system voltage rise or drop. Contingency analysis is used to calculate violations. Contingency analysis technique is being widely used to predict the effect of outages like failures of equipment, transmission line etc, and to take necessary actions to keep the power system secure and reliable.*
Practically, only selected contingencies will lead to severe conditions in power system. The project aims to conduct contingency analysis of ieee 9-bus system and determine the critical and non critical of the various elements of the power system in order of their priority
Key Words**:** *Optimal power flow, power world simulator, voltage security, SVC*

I INTRODUCTION

Contingency analysis is a vitally important part of any power system analysis effort. Industry planners and operators must analyze power systems covering scenarios such as the long-term effects on the transmission system of both new generation facilities and projected growth in load. Market analysts and planners must make informed decisions regarding transactions for energy trade - whether that trade is for the next hour or months down the road. PowerWorld Simulator's Contingency Analysis tools provide the ability not only to analyze a power system in its base case topology, but also to analyze the system that results from any statistically likely contingent scenario.
Industry planning and operating criteria often refer to the n-1 rule, which holds that a system must operate in a stable and secure manner following any single transmission or generation outage. In Power World Simulator, the individual contingency conditions can also be tailored to consist of either a single element (such as the loss of a transmission line or transformer), or multiple elements (such as the loss of a generator, several buses and a number of branches simultaneously). See Available Contingency Actions for a complete list of possible contingency actions.

II POWER SYSTEM CONTINGENCY

2.1 Contingency:

Modern operation computers have contingency programs stored in them. These foresee possible system troubles before they occur. They study outage events and alert the operators to any potential overloads or serious voltage violations. Thus contingency analysis carries out emergency identification and "what if" simulations

2.2 Contingency Selection:

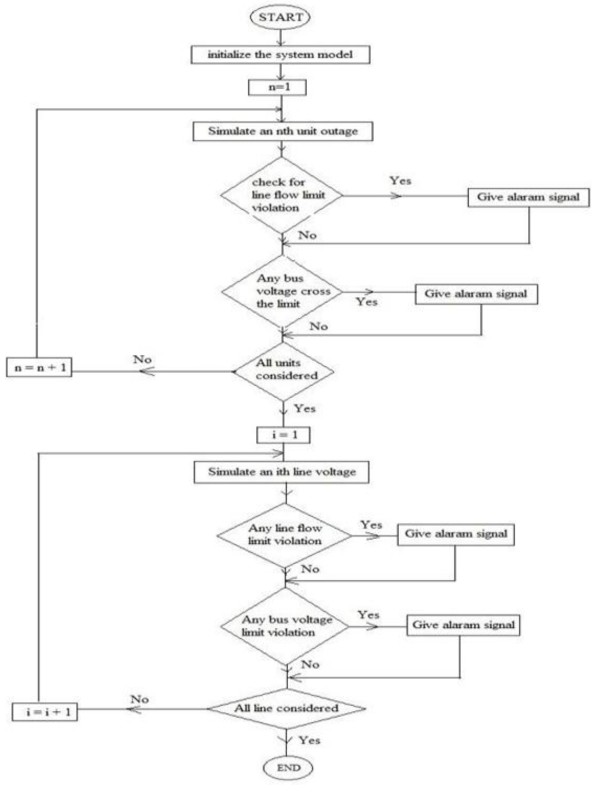
Direct Methods:
These involves screening and direct ranking of contingency cases. They monitor the appropriate post-contingent quantities (flows, voltages). The severity measure is often a performance index.

Indirect Method:
These give the values of the contingency case severity indices for ranking, without calculating the monitored contingent quantities directly.

2.3 Corrective action analysis:

It permits the operator to change the operation of the power system if a contingency analysis program predicts a serious problem in the event of the occurrence of a certain outage. Thus this provides preventive and post- contingency control.

2,4 Flow Chart For Contingency Analysis



III POWER SYSTEM STUDY

3.1 Power-flow study:

In power engineering, the power-flow study, or load-flow study, is a numerical analysis of the flow of electric power in an interconnected system. A power-flow study usually uses simplified notation such as a one-line diagram and per-unit system, and focuses on various aspects of AC power parameters, such as voltages, voltage angles, real power and reactive power. It analyzes the power systems in normal steady-state operation.

Power-flow or load-flow studies are important for planning future expansion of power systems as well as in determining the best operation of existing systems. The principal information obtained from the power-flow study is the magnitude and phase angle of the voltage at each bus, and the real and reactive power flowing in each line.

3.2 NEWTON–RAPHSON SOLUTION METHOD:

There are several different methods of solving the resulting nonlinear system of equations. The most popular is known as the Newton–Raphson method. This method begins with initial guesses of all unknown variables (voltage magnitude and angles at Load Buses and voltage angles at Generator Buses). Next, a Taylor Series is written, with the higher order terms ignored, for each of the power balance equations included in the system of equations.

3.3 GAUSS SEIDEL METHOD:

In numerical linear algebra, the Gauss–Seidel method, also known as the Liebmann method or the method of successive displacement, is an iterative method used to solve a linear system of equations.

IV POWER SYSTEM STABILITY

4.1 TEST DATA

Bus Data

Bus										
Number	Name	Area Name	Nom Kv	PU Volt	Volt (kV)	Angle (Deg)	Load MW	Load Mvar	Gen MW	Gen Mvar
1	1	1	138	1	138	0			72.07	9.53
2	2	1	138	1	138	-17.42			85	-36.59
3	3	1	138	1	138	-11.21			163	-36.33
4	4	1	138	1.03226	142.452	-23.71				
5	5	1	138	1.03086	142.259	-24.32	90	0		
6	6	1	138	1.02575	141.553	-16.55				
7	7	1	138	1.02634	141.635	-21.13	100	0		
8	8	1	138	1	141.62	-21.13				
9	9	1	138	1	142.5	-15.12	150	0		

Branch Data

Bus From Number	To Number	R	X	B
1	4	0	0.576	0
2	2	0	0.0625	0
3	6	0	0.0586	0
4	5	0.017	0.092	0.158
5	9	0.01	0.085	0.176
6	6	0.039	0.17	0.358
7	7	0.0119	0.1008	0.209
8	8	0.0085	0.072	0.149
9	2	0	0.0625	0
10	9	0.032	0.161	0.306
11	4	0.01	0.085	0.176

Generator Data

Generator					
Number of Bus	Name of Bus	ID	Status	Gen MW	Gen Mvar
1	1	1	Closed	72.07	9.53
2	2	1	Closed	85	-36.59
3	3	1	Closed	163	-36.33

4.2 SINGLE LINE DIAGRAM

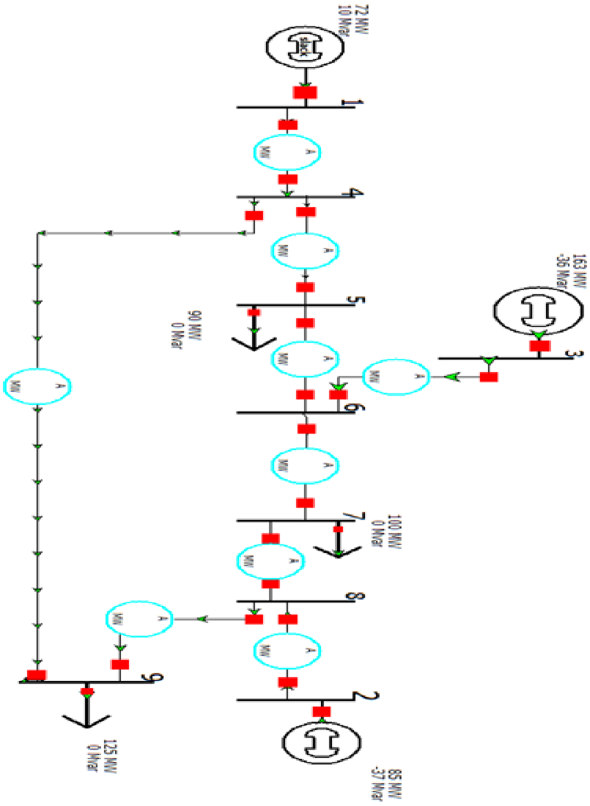


Fig.1 one line diagram for test datastable system

4.3 Case Study

4.3.1 Stable system

Bus data

	Number	Name	Area Name	Nom kV	PU Volt	Volt (kV)	Angle (Deg)	Load MW	Load Mvar	Gen MW	Gen Mvar	Switched Shunts Mvar	Act G Shunt MW	Act B Shunt Mvar
1	1	1	1	138.00	1.00000	138.000	0.00			68.81	11.87		0.00	0.00
2	2	2	1	138.00	1.00000	138.000	-8.81			165.00	-21.97		0.00	0.00
3	3	3	1	138.00	1.00000	138.000	-9.82			150.00	-27.11		0.00	0.00
4	4	4	1	138.00	1.01243	139.715	-23.05						0.00	0.00
5	5	5	1	138.00	1.00452	138.624	-25.38	150.00	0.00				0.00	0.00
6	6	6	1	138.00	1.01968	140.716	-14.77						0.00	0.00
7	7	7	1	138.00	1.02122	140.928	-17.04	100.00	0.00				0.00	0.00
8	8	8	1	138.00	1.01896	140.617	-14.62						0.00	0.00
9	9	9	1	138.00	1.01060	139.462	-24.17	125.00	0.00				0.00	0.00

Fig: Bus Data

Branch Data

	From Number	From Name	To Number	To Name	Circuit	Status	Branch Device Type	Xfrmr	MW From	Mvar From	MVA From	Lim MVA	% of MVA Limit (Max)	MW Loss	Mvar Loss
1	1	1	4	4	1	Closed	Line	NO	68.8	11.9	69.8	0.0	0.0	0.00	28.08
2	8	8	2	2	1	Closed	Line	NO	-165.0	39.3	169.6	0.0	0.0	0.00	17.32
3	3	3	6	6	1	Closed	Line	NO	150.0	-27.1	152.4	0.0	0.0	0.00	13.62
4	4	4	5	5	1	Closed	Line	NO	45.2	-6.8	45.7	0.0	0.0	0.34	-14.23
5	4	4	9	9	1	Closed	Line	NO	23.6	-9.4	25.4	0.0	0.0	0.05	-17.55
6	5	5	6	6	1	Closed	Line	NO	-105.1	7.4	105.4	0.0	0.0	4.52	-16.96
7	6	6	7	7	1	Closed	Line	NO	40.4	-16.4	43.6	0.0	0.0	0.19	-20.16
8	7	7	8	8	1	Closed	Line	NO	-59.8	3.8	60.0	0.0	0.0	0.30	-12.94
9	8	8	9	9	1	Closed	Line	NO	104.9	-22.6	107.3	0.0	0.0	3.40	-14.39

Fig: Branch Data

Generator data

	Number of Bus	Name of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max MW	Min Mvar	Max Mva ▲	Cost Model	Part. Factor
1	1	1	1	Closed	68.81	11.87	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
2	2	2	1	Closed	165.00	-21.97	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
3	3	3	1	Closed	150.00	-27.11	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00

Fig: Generator Data

4.3.2 System when generator 1 is opened

Bus data

	From Number	From Name	To Number	To Name	Circuit	Status	Branch Device Type	Xfrmr	R	X	B	Lim MVA A	Lim MVA B	Lim MVA C
1	1	1	4	4	1	Closed	Line	NO	0.00000	0.57600	0.00000	0.0	0.0	0.0
2	8	8	2	2	1	Closed	Line	NO	0.00000	0.06250	0.00000	0.0	0.0	0.0
3	3	3	6	6	1	Closed	Line	NO	0.00000	0.05860	0.00000	0.0	0.0	0.0
4	4	4	5	5	1	Closed	Line	NO	0.01700	0.09200	0.15800	0.0	0.0	0.0
5	4	4	9	9	1	Closed	Line	NO	0.01000	0.08500	0.17600	0.0	0.0	0.0
6	5	5	6	6	1	Closed	Line	NO	0.03900	0.17000	0.35800	0.0	0.0	0.0
7	6	6	7	7	1	Closed	Line	NO	0.01190	0.10080	0.20900	0.0	0.0	0.0
8	7	7	8	8	1	Closed	Line	NO	0.00850	0.07200	0.14900	0.0	0.0	0.0
9	8	8	9	9	1	Closed	Line	NO	0.03200	0.16100	0.30600	0.0	0.0	0.0

Fig: Bus Data

Branch data

	From Number	From Name	To Number	To Name	Circuit	Status	Branch Device Type	Xfrmr	MW From	Mvar From	MVA From	Lim MVA	% of MVA Limit (Max)	MW Loss	Mvar Loss
1	1	1	4	4	1	Closed	Line	NO	-0.0	0.0	0.0	0.0	0.0	0.00	0.00
2	8	8	2	2	1	Closed	Line	NO	-240.3	32.4	242.4	0.0	0.0	0.00	36.09
3	3	3	6	6	1	Closed	Line	NO	150.0	-15.4	150.8	0.0	0.0	0.00	13.32
4	4	4	5	5	1	Closed	Line	NO	20.2	-2.4	20.3	0.0	0.0	0.08	-15.06
5	4	4	9	9	1	Closed	Line	NO	-20.2	2.4	20.3	0.0	0.0	0.05	-16.80
6	5	5	6	6	1	Closed	Line	NO	-129.9	12.7	130.5	0.0	0.0	7.14	-4.63
7	6	6	7	7	1	Closed	Line	NO	13.0	-11.4	17.3	0.0	0.0	0.02	-21.26
8	7	7	8	8	1	Closed	Line	NO	-87.0	9.9	87.6	0.0	0.0	0.65	-9.67
9	8	8	9	9	1	Closed	Line	NO	152.6	-12.8	153.1	0.0	0.0	7.32	6.37

Fig: Branch Data

Generator data

	Number of Bus	Name of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max MW	Min Mvar	Max Mva ▲	Cost Model	Part. Factor
1	1	1	1	Open	0.00	0.00	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
2	2	2	1	Closed	6.25	124.92	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
3	3	3	1	Closed	147.96	589.78	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00

Fig: Generator Data

4.3.3 System when generator 1 and 2 are opened

Bus data

	Number	Name	Area Name	Nom kV	PU Volt	Volt (kV)	Angle (Deg)	Load MW	Load Mvar	Gen MW	Gen Mvar	Switched Shunts Mvar	Act G Shunt MW	Act B Shunt Mvar	Area Num
1	1	1	1	138.00	0.99370	137.130	-32.67			0.00	0.00		0.00	0.00	1
2	2	2	1	138.00	1.00000	138.000	-8.81			240.26	3.73		0.00	0.00	1
3	3	3	1	138.00	1.00000	138.000	-15.25			150.00	-15.37		0.00	0.00	1
4	4	4	1	138.00	0.99370	137.130	-32.67						0.00	0.00	1
5	5	5	1	138.00	0.98540	135.985	-33.70	150.00	0.00				0.00	0.00	1
6	6	6	1	138.00	1.01283	139.770	-20.23						0.00	0.00	1
7	7	7	1	138.00	1.01205	139.663	-20.97	100.00	0.00				0.00	0.00	1
8	8	8	1	138.00	1.00891	139.229	-17.37						0.00	0.00	1
9	9	9	1	138.00	0.98642	136.126	-31.60	125.00	0.00				0.00	0.00	1

Fig: Bus Data

Branch data

	From Number	From Name	To Number	To Name	Circuit	Status	Branch Device Type	Xfrmr	MW From	Mvar From	MVA From	Lim MVA	% of MVA Limit (Max)	MW Loss	Mvar Loss
1	1	1	4	4	1	Closed	Line	NO	-0.0	-0.0	0.0	0.0	0.0	0.00	0.00
2	8	8	2	2	1	Closed	Line	NO	0.0	-0.0	0.0	0.0	0.0	0.00	0.00
3	3	3	6	6	1	Closed	Line	NO	409.4	215.4	462.6	0.0	0.0	0.00	125.40
4	4	4	5	5	1	Closed	Line	NO	-33.8	12.9	36.2	0.0	0.0	0.39	-7.68
5	4	4	9	9	1	Closed	Line	NO	33.8	-12.9	36.2	0.0	0.0	0.19	-9.55
6	5	5	6	6	1	Closed	Line	NO	-184.2	20.8	185.4	0.0	0.0	22.28	71.49
7	6	6	7	7	1	Closed	Line	NO	202.9	39.2	206.7	0.0	0.0	6.30	37.14
8	7	7	8	8	1	Closed	Line	NO	96.6	2.2	96.7	0.0	0.0	1.09	-1.48
9	8	8	9	9	1	Closed	Line	NO	95.5	3.6	95.6	0.0	0.0	4.21	0.55

Fig: Branch Data

Generator data

	Number of Bus	Name of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max MW	Min Mvar	Max Mva ▲	Cost Model	Part. Factor
1	1	1	1	Open	0.00	0.00	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
2	2	2	1	Open	0.00	0.00	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
3	3	3	1	Closed	147.96	589.78	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00

Fig: Generator Data

4.3.4 System when generator 2 and 3 is opened

Bus data

	Number	Name	Area Name	Nom kV	PU Volt	Volt (kV)	Angle (Deg)	Load MW	Load Mvar	Gen MW	Gen Mvar	Switched Shunts Mvar	Act G Shunt MW	Act B Shunt Mvar	Area Num
1	1	1	1	138.00	0.00003	0.004	100.69			0.00	0.00		0.00	0.00	1
2	2	2	1	138.00	0.55241	76.232	-66.77			0.00	0.00		0.00	0.00	1
3	3	3	1	138.00	1.00000	138.000	-24.53			334.16	439.19		0.00	0.00	1
4	4	4	1	138.00	0.39742	54.844	-83.81						0.00	0.00	1
5	5	5	1	138.00	0.43999	60.718	-77.97	104.47	0.00				0.00	0.00	1
6	6	6	1	138.00	0.76802	105.986	-39.30						0.00	0.00	1
7	7	7	1	138.00	0.61723	85.178	-59.18	96.59	0.00				0.00	0.00	1
8	8	8	1	138.00	0.55241	76.232	-66.77						0.00	0.00	1
9	9	9	1	138.00	0.41929	57.862	-90.60	81.62	0.00				0.00	0.00	1

Fig: Bus Data

Branch data

	From Number	From Name	To Number	To Name	Circuit	Status	Branch Device Type	Xfrmr	MW From	Mvar From	MVA From	Lim MVA	% of MVA Limit (Max)	MW Loss	Mvar Loss
1	1	1	4	4	1	Closed	Line	NO	-0.0	0.0	0.0	0.0	0.0	0.00	0.00
2	8	8	2	2	1	Closed	Line	NO	-0.0	0.0	0.0	0.0	0.0	0.00	0.00
3	3	3	6	6	1	Closed	Line	NO	409.4	215.4	462.6	0.0	0.0	0.00	125.39
4	4	4	5	5	1	Closed	Line	NO	-33.8	12.9	36.2	0.0	0.0	0.39	-7.68
5	4	4	9	9	1	Closed	Line	NO	33.8	-12.9	36.2	0.0	0.0	0.19	-9.55
6	5	5	6	6	1	Closed	Line	NO	-184.2	20.8	185.4	0.0	0.0	22.28	71.49
7	6	6	7	7	1	Closed	Line	NO	202.9	39.3	206.7	0.0	0.0	6.30	37.14
8	7	7	8	8	1	Closed	Line	NO	96.6	2.2	96.7	0.0	0.0	1.09	-1.48
9	8	8	9	9	1	Closed	Line	NO	95.5	3.6	95.6	0.0	0.0	4.21	0.55

Fig: Branch Data

Generator data

	Number of Bus	Name of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max MW	Min Mvar	Max Mvar	Cost Model	Part. Factor
1	1	1	1	Closed	-80.80	95.72	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
2	2	2	1	Open	0.00	0.00	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
3	3	3	1	Open	0.00	0.00	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00

Fig: Generator Data

4.3.5 System when generator 1 and 3 are opened

Bus data

	Number	Name	Area Name	Nom kV	PU Volt	Volt (kV)	Angle (Deg)	Load MW	Load Mvar	Gen MW	Gen Mvar	Switched Shunts Mvar	Act G Shunt MW	Act B Shunt Mvar	Area Num
1	1	1	1	138.00	0.87243	120.396	-40.90			0.00	0.00		0.00	0.00	1
2	2	2	1	138.00	1.00000	138.000	0.00			400.93	155.26		0.00	0.00	1
3	3	3	1	138.00	0.91138	125.771	-32.50			0.00	0.00		0.00	0.00	1
4	4	4	1	138.00	0.87243	120.396	-40.90						0.00	0.00	1
5	5	5	1	138.00	0.86894	119.914	-44.75	150.00	0.00				0.00	0.00	1
6	6	6	1	138.00	0.91138	125.771	-32.50						0.00	0.00	1
7	7	7	1	138.00	0.91684	126.524	-25.38	100.00	0.00				0.00	0.00	1
8	8	8	1	138.00	0.93709	129.318	-15.51						0.00	0.00	1
9	9	9	1	138.00	0.86328	119.133	-37.25	125.00	0.00				0.00	0.00	1

Fig: Bus Data

Branch data

	Number	Name	Area Name	Nom kV	PU Volt	Volt (kV)	Angle (Deg)	Load MW	Load Mvar	Gen MW	Gen Mvar	Switched Shunts Mvar	Act G Shunt MW	Act B Shunt Mvar	Area Num
1	1	1	1	138.00	1.00000	138.000	0.00			0.00	0.00		0.00	0.00	1
2	2	2	1	138.00	1.00000	138.000	4.81			165.00	-21.97		0.00	0.00	1
3	3	3	1	138.00	1.00000	138.000	-9.82			0.00	0.00		0.00	0.00	1
4	4	4	1	138.00	1.01243	139.715	-23.05						0.00	0.00	1
5	5	5	1	138.00	1.00452	138.624	-25.38	150.00	0.00				0.00	0.00	1
6	6	6	1	138.00	1.01968	140.716	-14.77						0.00	0.00	1
7	7	7	1	138.00	1.02122	140.928	-17.04	100.00	0.00				0.00	0.00	1
8	8	8	1	138.00	1.01896	140.617	-14.62						0.00	0.00	1
9	9	9	1	138.00	1.01060	139.462	-24.17	125.00	0.00				0.00	0.00	1

Fig: Branch Data

Generator data

	Number of Bus	Name of Bus	ID	Status	Gen MW	Gen Mvar	Set Volt	AGC	AVR	Min MW	Max MW	Min Mvar	Max Mvar	Cost Model	Part. Factor
1	1	1	1	Open	0.00	0.00	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
2	2	2	1	Closed	6.25	124.92	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00
3	3	3	1	Open	0.00	0.00	1.00000	YES	YES	0.00	1000.00	-9900.00	9900.00	Cubic	10.00

Fig: Generator Data

4.4 COMPARISON OF THE STUDY:

Branch data comparison

			Stable state		Gen 1 is open		Gen 1& 2 are open		Gen 2 & 3 are open		Gen 3 & 1 are open	
S.no	From bus	To Bus	Mw	Mw loss	Mw	Mw loss	Mw	Mw loss	Mw	Mw loss	Mw	Mw loss
1	1	4	68.8	28.08	0	0	0	0	390.3	0	0	0
2	8	2	-165	17.32	-24.3	36.09	0	0	0	0	0	0
3	3	6	150	13.62	150	13.32	409.14	0	0	0	462.6	0
4	4	5	45.2	-14.23	29.2	-15.06	-33.8	0.39	194.3	5.28	36.2	0.39
5	4	9	23.6	-17.55	-20.2	-16.80	33.8	0.19	196.0	3.12	36.2	0.19
6	5	6	-105.1	-16.96	-121.9	-4.63	-184.2	22.28	39	3.47	185.5	22.28
7	6	7	40.4	-20.69	13	-21.2	202.9	6.30	35.6	0.05	206.7	6.30
8	7	8	-59.8	-12.94	-87	-9.67	96.6	1.09	-64.5	0.15	96.7	1.09
9	8	9	104.9	-14.39	152.6	6.37	95.5	4.21	-64.6	3.2	95.5	4.21

GENERATOR COMPARISON:

		Stable state		Gen 1 is open		Gen 1& 2 are open		Gen 2 & 3 are open		Gen 3 & 1 are open	
S.no	Gen no	Gen Mw	Gen Mvar	Gen Mw	Gen Mvar	Gen Mw	Gen Mvar	Gen Mw	Gen Mvar	Gen Mw	Gen Mvar
1	1	-80.8	95.72	0	0	0	0	-80.80	95.72	0	0
2	2	240.26	143.73	6.25	124.92	0	0	0	0	6.25	124.92
3	3	409.38	334.57	409.38	216.92	147.96	589.78	0	0	0	0

V CONCLUSION

The corrective actions effectively removed the limit violations in the system. The results obtained through the proposed algorithm are found to be quite accurate and thus, this work provides new tool for developing remedial control actions for higher order contingencies. Contingency analysis study helps to strengthen the initial basic plan. It is also helpful to develop system operators to improve their ability to resolve problem. This tool helps especially the busy power system operators. The difference in line flows and bus voltages would show how the lost generation is shared by the remaining units. Again it is important to know which line or unit outages will render line flows or voltages to cross the limits. To find the effects of outages contingency analysis techniques are employed.

REFERENCES:

1. ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=618475 1
2. www.powerworld.com/files/TrainingI10ContingencyA nalysis

3. https://www.researchgate.net/publication/264555752_CONTINGENCY_ANALYSIS_IN_POWER_SYSTEM
4. etap.com/transmission/contingency-analysis.htm?lang=en-US
5. www.mantenimientopetroquimica.com/en/faultanalysis.html
6. www.mantenimientopetroquimica.com/en/performance of cost and economic.html
7. Gross, C. A. 1986. Power System Analysis. New York:John Wiley & Sons.
8. Ram, B., and Vishwakarna, D. N. 1995. Power System Protection and Switchgear. New Delhi: TataMcGraw-Hill.
9. Power system analysis by HadiSaadat, 2005 Tata McGraw-Hill

BIBILOGRAPHY

Mrs. V L Surya Prabha, is Graduated from JITM, Parlakimundi, Orrisa, in the year 2004, M.Tech from Vitam, Vishakapatnam, Andhrapradesh in the year 2015. She is presently working as Assistant Professor in the Department of Electrical and Electronics Engineering, Lords Inst of Engg. & Tech., Himayat sagar, Hyderabad, Telangana, India. Her research areas include Power Systems & Instrument Transformers.

Mr. Baikani Prashanth, is a final year student of dept of Electrical and Electronics Engineering, Lords Inst of Engg. & Tech., Himayat sagar, Hyderabad, Telangana, India. He is pursuing his project study in the area of power systems and controller.

Mr. Shaik Mateen, is final year student of dept of Electrical and Electronics Engineering, Lords Inst of Engg. & Tech., Himayatsagar, Hyderabad, Telangana, India. She is pursuing her project study in the area of power systems and controller.

Mr. Mohammad Kamran Shams, is a final year student of dept of Electrical and Electronics Engineering, Lords Inst of Engg. & Tech. Himayatsagar, Hyderabad, Telangana, India. He is pursuing his project study in the area of power systems and controller

Mr. Mohammed Shahzoor, is a final year student of dept of Electrical and Electronics Engineering, Lords Inst of Engg. & Tech. Himayatsagar, Hyderabad, Telangana, India. He is pursuing his project study in the area of power systems and controller