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A Survey on Study of thermal Power Generation & Grid Stability Using MATLAB

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ABSTRACT

This Research relate the study of a TPG unit, along with simulation studies to determine balance grid in a PS. A brief analysis of Aurangabad S/Station has been made using MATLAB. A brief study of each component & simulation of model also performed. The power exchange network has been study & control by LDC on SCADA system, for control of true & imaginary power. Two parallel circuit lines, with two transformers, are studied in the simulation model. A Fault is created in one line. Active & Imaginary power of the normal also the fault created line are studied and graph with MATLAB.

Keywords: CADA, LDC, MATLAB, SCADA SYSTEM

I. INTRODUCTION

The assessment of security of large scale, non-linear power grids is a challenging task expensive task. [1] targets at decreasing the computational cost, by utilizing a robust assessment toolbox for carrying out the risk assessment study. [2] proposes Indirect method for stabilizing power system working on fuzzy logic & basis parameters for stability of system. [3] presents the study and stimulation of power system balance on fuzzy logic parameters and compare with PID based stabilizer. Hardware model is also constructed on fuzzy parameters for power system stabilizer on laboratory scale & also demonstrated.[4] presents the tuning procedure for stabilize of power system installed on generating units of a power station in Iran. Design criteria has also presented for the stabilizer, along with some field test results. [5] describes a fuzzy logic based An PS stabilizer. The stabilizer uses accelerating power and deviation of speed as input variables of the controller. [6] proposes an adaptive fuzzy PS stabilizer. The balance consists of a predictor based on the generalized neuron (GN) technique, along with a fuzzy logic controller.

The present study considers a model of a PS substation. The substation has two parallel lines, with a transformer each. A fault is induced in one of the parallel lines. The true and imaginary powers of both the lines are studied and plotted using MATLAB. Suggestions for getting better the balance of the power system are presented.

Plight Study:

According to the load and fluctuating frequency as the frequency is one big criteria for Continuity of the grid and for maintaining the grid stable. The working, Function & operation of LDC are studied, Where different case & modes are studied, The increase & decrease in generation also, studied the frequency graph.

Normal Mode Case:

In normal operating case, It take place in LDC which working as well as operation of LDC Ambazari. The operating regions are Vidharbha,Khandesh & Marathwada.

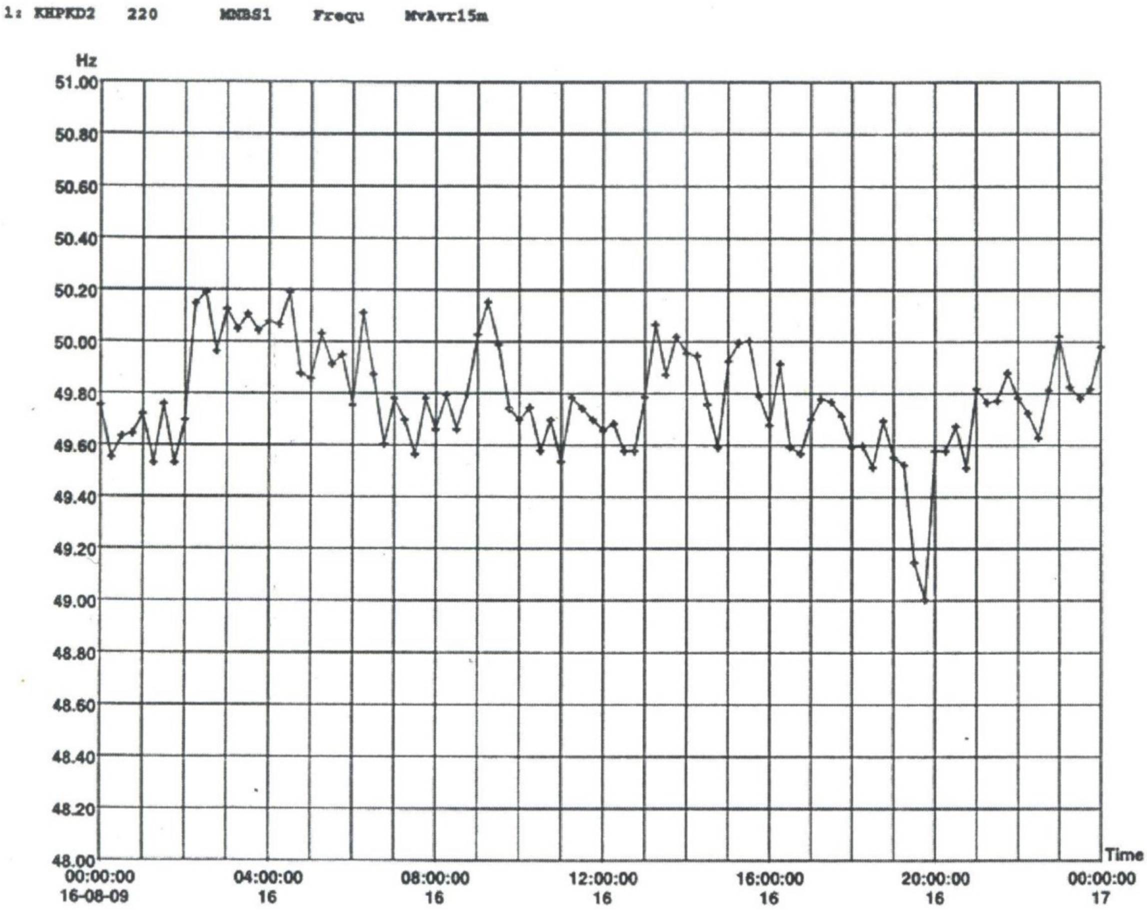
Table 1. Generating Capacity

Sr. No.	Category of Power station	Installed Capacity	
		MSEB	MAH. State (MW)
1	Thermal	6425	6925
2	Hydro	2434	2878
3	Gas	912	2242
4	Total	9771	12045

The daily routine generation of MSEB is as showing in Table 1 during the time of peak load period i.e. 20-22 hrs there is a peak demand. During these times for maintaining the system to be stable LDC take Hydro Stations in consideration as shown in below Table

ALDC,MSEB,Ambazari	**Station wise Generation(MW)-Hourly Average**											
Sunday, August 16,2009												
	13:00	**14:00**	**15:00**	**16:00**	**17:00**	**18:00**	**19:00**	**20:00**	**21:00**	**22:00**	**23:00**	**00:00**
1.NASIK	592	588	574	576	582	576	582	581	578	575	574	583
2.BHSWK1	391	391	384	381	370	362	350	375	391	371	373	373
3.KORDY	457	452	491	516	510	508	475	479	504	510	531	525
4.PARLY1	580	611	615	604	589	596	611	618	616	617	617	616
5.CHDPR	1332	1353	1384	1390	1367	1364	1383	1483	1605	1574	1423	1370
6.KHPKHD2	813	811	810	822	820	821	820	810	812	806	811	815
7.PARAS	42	47	48	47	46	38	31	42	43	44	44	42
8.MSEB(THERMAL)	4357	4412	4479	4500	4445	4442	4438	4576	4746	4682	4577	4464
9.KOYNA1&2	34	33	72	33	44	34	120	260	49	35	238	155
10.KOYNA3	11	11	11	11	11	191	231	232	232	233	234	236
11.KOYNA4	199	15	60	238	307	330	609	1027	1058	615	264	191
12.KDPH	0	0	0	0	0	0	0	0	0	0	0	0
13.VTRNA	0	0	0	0	0	0	0	0	52	60	60	60
14.TILLRY	0	0	0	0	0	0	0	0	0	0	0	0
15.BTR	80	80	80	80	80	80	80	80	80	80	80	80
16.OTHERS	0	0	0	0	0	0	0	0	0	0	0	0
17.MSEB(HYDRO)	233	48	132	271	351	363	729	1287	1107	650	602	346
18.URAN(GAS)	368	641	625	613	598	601	643	636	652	654	656	659
19.MSEB(TOTAL)	5315	5181	5311	5461	5476	5635	6120	6809	6867	6364	6096	5879
20.TATA(THERMAL)	1313	1306	1325	1327	1320	1271	1276	1330	1332	1331	1329	1327
21.TATA(HYDRO)	103	58	13	4	1	1	4	123	189	190	85	17
22.TATA(TOTAL)	1416	1364	1336	1330	1322	1272	1280	1453	1521	1521	1414	1344
23.BSES	506	505	503	502	503	503	503	503	503	504	504	504
24.DABHOL	638	638	638	638	638	638	638	638	638	638	638	638
25.STATE(TOTAL)	8076	7889	7992	8132	8034	8241	8746	9664	9906	9339	8880	8575
FREQ.												
26.KHPKD	49.66	49.96	49.80	49.87	49.69	49.71	49.59	49.31	49.65	49.80	49.80	49.85
27.CHDPR	49.67	49.99	49.82	49.88	49.71	49.73	49.60	49.33	49.66	49.81	49.81	49.86
28.KALWA2	49.64	49.96	49.79	49.85	49.67	49.70	49.57	49.29	49.63	49.78	49.77	49.83

The frequency curve for 24 hrs in graph. At off load demand in the frequency fluctuate between 50Hz to 50.20Hz, while peak load the frequency fluctuating between 49.80-49.60HZ.This operation are performed by LDC



4.1

Alert Mode Case:

Another case which belongs to alert mode operation of L.D.C. Here contingency occurs due which Fault in 500 MW units. Now looking over Tab. 4.3 Parly station goes out operation after the occurrence of fault. Also Koradi and Khaperkheda switch off operation due to occurrence of fault or trip off of sub-stations. Now the frequency also gets fluctuated below forty-nine point eighty Hz. 4.2

Now at such a time L.D. take Hydro station on Bar/consideration. Hydro stations met the demand of thermal stations continue the frequency. Now still frequency is below appropriate level at this time some power is withdrawal from central sector, from another states as per the ABT rules and the demand is met.

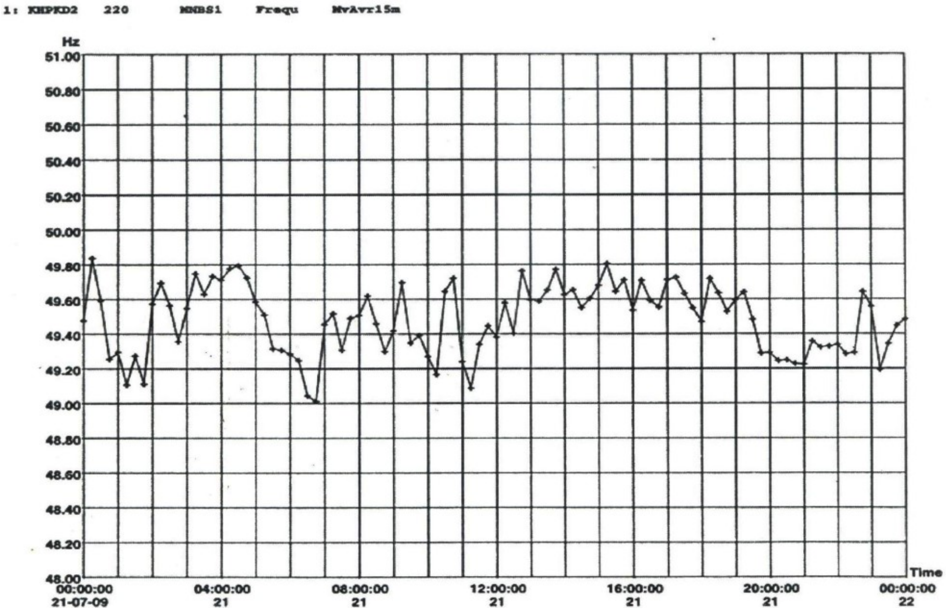
ALDC,MSEB,Ambazari				**Station wise Generation(MW)-Hourly Average**								
Tuesday, July 21,2009												
	01:00	**02:00**	**03:00**	**04:00**	**05:00**	**06:00**	**07:00**	**08:00**	**09:00**	**10:00**	**11:00**	**12:00**
1.NASIK	600	445	428	419	424	426	428	420	425	425	421	426
2.BHSWK1	307	288	260	234	189	211	202	191	159	116	104	102
3.KORDY	423	404	239	148	131	129	129	129	116	0	0	0
4.PARLY1	507	24	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
5.CHDPR	1247	1162	1158	1152	1144	1125	1124	1109	1096	1066	1017	1006
6.KHPKHD2	645	644	616	648	632	588	411	0	0	0	0	1
7.PARAS	18	0	0	0	0	0	0	0	0	0	0	0
8.MSEB(THERMAL)	3954	3108	2853	2755	2686	2624	2508	1954	1853	1785	1692	1689
9.KOYNA1&2	34	77	57	39	33	193	332	49	32	34	34	79
10.KOYNA3	0	0	0	0	0	0	0	11	125	152	162	215

11.KOYNA4	-11	47	31	-10	-10	222	719	887	829	829	837	868
12.KDPH	0	0	0	0	0	0	0	0	0	0	0	0
13.VTRNA	0	0	0	0	0	0	0	0	0	0	0	0
14.TILLRY	0	0	0	0	0	0	0	0	0	0	0	0
15.BTR	80	80	80	80	80	80	80	80	80	80	80	80
16.OTHERS	0	0	0	0	0	0	0	0	0	0	0	0
17.MSEB(HYDRO)	23	124	87	28	23	414	1051	936	861	863	872	948
18.URAN(GAS)	388	312	317	319	318	301	302	282	268	299	243	221
19.MSEB(TOTAL)	4527	3930	3592	3294	3154	3049	3812	3516	3153	3176	3138	3045
20.TATA(THERMAL)	1096	960	901	850	852	920	1052	1203	1287	1298	1302	1306
21.TATA(HYDRO)	82	82	82	82	82	82	82	204	335	473	474	474
22.TATA(TOTAL)	1178	1042	963	932	934	1003	1134	1407	1621	1772	1775	1780
23.BSES	513	513	512	512	512	513	513	515	514	514	512	511
24.DABHOL	643	643	643	643	643	643	643	643	643	643	643	643
25.STATE(TOTAL)	7602	7602	7602	7602	7602	7602	7602	7602	7602	7602	7602	7602
FREQ.												
26.KHPKD	49.49	49.27	49.54	49.71	49.72	49.35	49.19	49.45	49.45	49.43	49.44	49.31
27.CHDPR	49.51	49.28	49.55	49.72	49.73	49.37	49.20	49.47	49.46	49.44	49.46	49.33
28.KALWA2	49.48	49.24	49.52	49.69	49.70	49.34	49.17	49.44	49.43	49.41	49.43	49.29

ALDC,MSEB,Ambazari	**Station wise Generation(MW)-Hourly Average**											
Tuesday, July 21,2009												
	13:00	**14:00**	**15:00**	**16:00**	**17:00**	**18:00**	**19:00**	**20:00**	**21:00**	**22:00**	**23:00**	**00:00**
1.NASIK	424	437	431	429	427	426	419	415	410	416	399	412
2.BHSWK1	61	74	97	114	97	97	122	134	121	115	130	122
3.KORDY	0	0	0	0	0	0	0	0	0	0	0	0
4.PARLY1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
5.CHDPR	999	1042	1052	1012	956	1024	1046	1064	1046	1078	1074	1077
6.KHPKHD2	1	1	1	1	1	1	1	1	6	81	109	159
7.PARAS	0	0	0	0	0	0	0	0	0	0	0	0
8.MSEB(THERMAL)	1635	1705	1711	1679	1647	1685	1722	1793	1731	1843	1858	1875
9.KOYNA1&2	34	34	34	34	34	34	39	259	502	287	59	263
10.KOYNA3	274	303	308	304	307	313	314	315	316	317	316	316
11.KOYNA4	829	829	828	829	828	829	906	1093	1131	1126	859	440
12.KDPH	0	0	0	0	0	0	0	0	0	0	0	0
13.VTRNA	0	0	0	0	0	0	0	0	0	0	0	0
14.TILLRY	0	0	0	0	0	0	0	0	0	0	0	0
15.BTR	80	80	80	80	80	80	80	80	80	80	80	80
16.OTHERS	0	0	0	0	0	0	0	0	0	0	0	0
17.MSEB(HYDRO)	863	863	863	863	863	863	945	1351	1632	1413	917	702
18.URAN(GAS)	224	225	225	179	167	179	186	186	196	253	358	396
19.MSEB(TOTAL)	3055	3130	3221	3189	3079	3115	3086	3418	3973	1003	3619	3073
20.TATA(THERMAL)	1306	1301	1290	1294	1261	1274	1270	1264	1263	1254	1217	1214
21.TATA(HYDRO)	474	474	373	249	252	302	329	355	328	244	183	81
22.TATA(TOTAL)	1779	1774	1663	1560	1513	1576	1599	1619	1591	1499	1401	1295
23.BSES	514	515	514	515	514	515	513	512	513	514	514	514
24.DABHOL	643	643	643	643	643	643	643	643	643	643	643	643
25.STATE(TOTAL)	7602	7602	7602	7602	7602	7602	7602	7602	7602	7602	7602	7602
FREQ.												
26.KHPKD	49.58	49.66	49.62	49.67	49.64	49.59	49.62	49.43	49.24	49.34	49.44	49.37
27.CHDPR	49.60	49.67	49.64	49.69	49.66	49.66	49.61	49.63	49.44	49.24	49.46	49.38
28.KALWA2	49.57	49.64	49.60	49.66	49.62	49.58	49.60	49.41	49.22	49.32	49.42	49.35

In this way Tab.4.4 though there is loss of Energy from 3954 MW to 1875 MW i.e. nearly 1300 MW power is loss still their no blackout occurred. In this way by performing such a operations stability is maintained by L.D.

The frequency curve 4.2. Here the frequency is varying below 49 Hz. The stability is maintained.

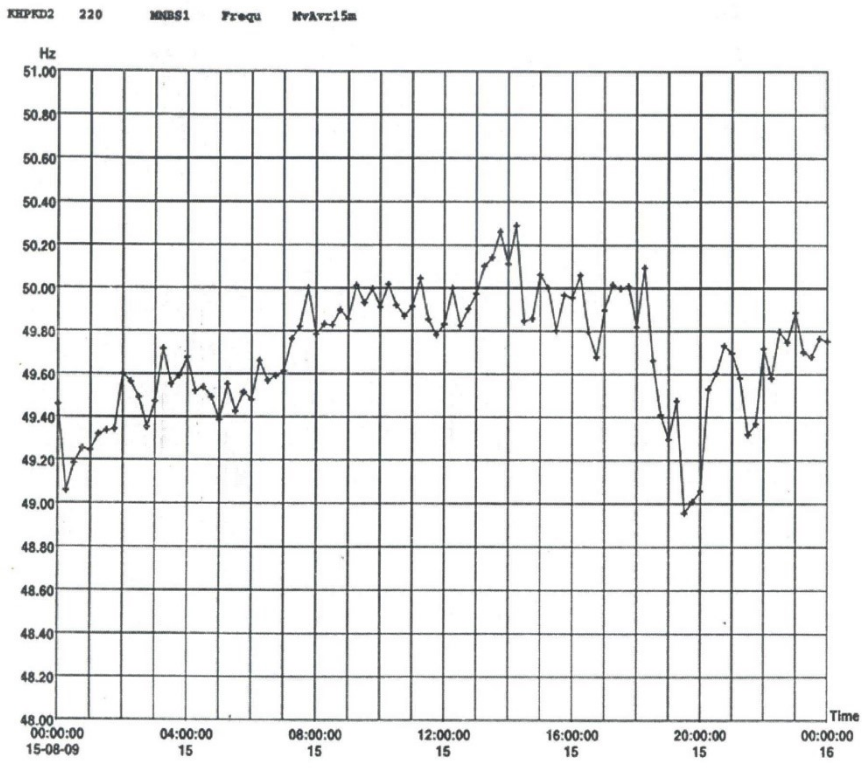


4.2

Emergency mode case

Another case in which the generation is as per routine and the load is off. Due to this switch off of load phenomenon of over voltage occurs which indicates that lesser demand related to generation.

At such situation LDC operator removes all the load from the loaded region. Even then also frequency is not in prescribe limit. High paying station are switch off. Ex cost of Paras Unit is high than Chandrapur. Then Chandrapur is low than Paras .Hence Paras unit highest priority and it should be turn off firstly. The frequency curve 4.3. Ti is seen that at some hours the frequency is above 50.20 Hz and at remaining hours it nearly equal to 50.20.Hz. In this way the stability is maintained. In this manner by various function are performed by Load Dispatched (L.D.) Continuity of overall grid system can be maintained.



4.3

System Simulation

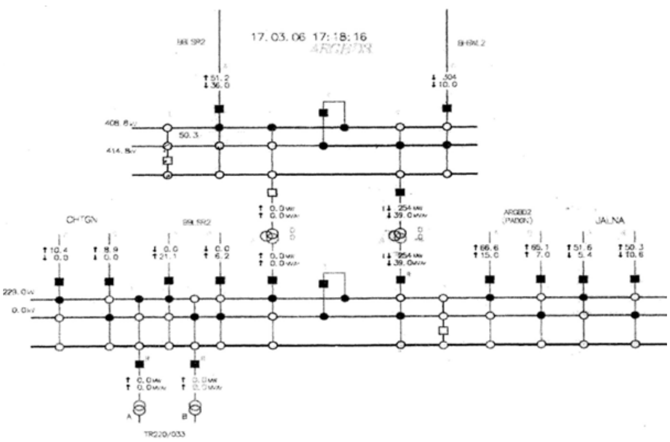
In this project we are studying simulation of SCADA SYSTEM. The simulation of this programs we have limited our vision to two transformer on which fault occurs. The fault created in simulation based on the data given by SCADA during real time fault. We display the output of simulation using different graphs for active power and reactive power also we display graphs of current of normal transformer and faulty transformer.

Actual Analysis

The transformation system has two quantities, quality and stability. The above quantity of electrical system are dependent of each other if one is done, other will also be.

When we are dealing with transmission lines, we have to generation system, it means generator supplying output, transmitting transferring to a load point through network.

Fig 1. shows line diagram of 400/220 KV Substation. In which 400 KV Main Bus-I and II voltage level shown. Third bus is Transfer Bus as per arrangement of BUS system. Close Square in Red colour shows status of BREAKER and round close circle shows STATUS of ISOLATOR. Close indications shows lines are in service. In green colour 220 KV bus shown in single line diagram.



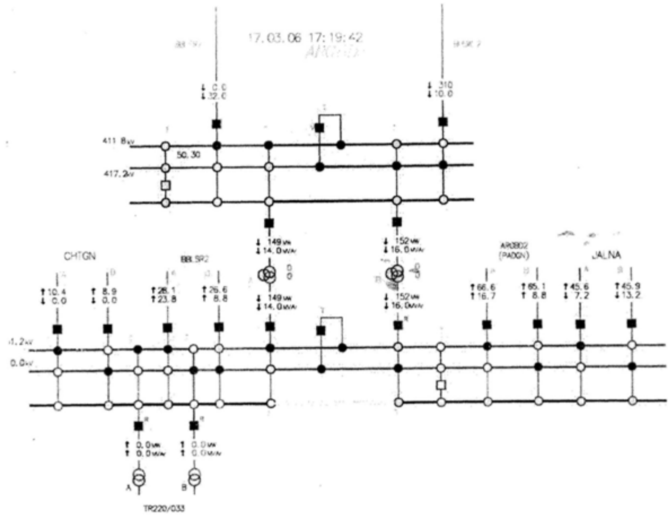
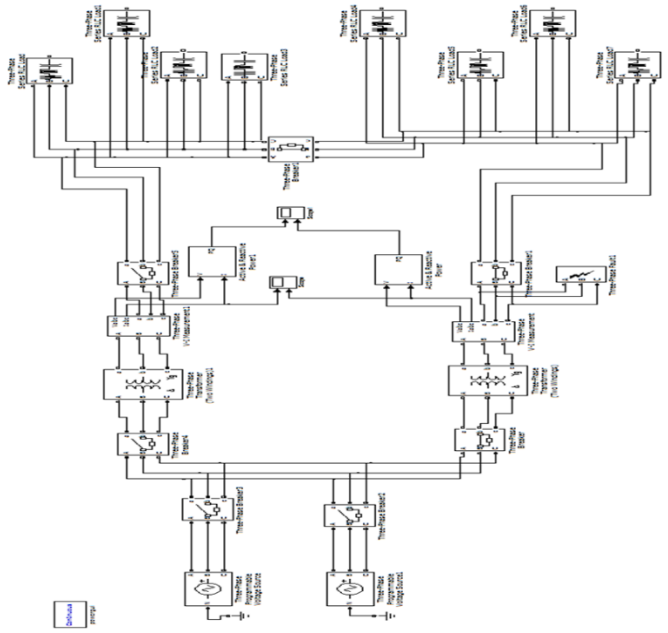


Figure 1. Analysis of Substation

Simulation on Modelling



Here there are two three phase power sources a 400 KV, 50 Hz, A B C phase sequences. Which are attached to common bus 1 which is at 400 KV 50 Hz. Output of the bus is attached to the transformer X1 and X2 through CB3, CB4 respectively which is primary side CB transformer both the transformer are rated at 150 MW, 400 KV/ 200 KV, 50 Hz.

Secondary of both transformer are attached to bus 2 through the CB7 and CB1 respectively and through three phase measurement block. Bus 2 is rated at 200 KV. Transformer 2 is also attached in the same fashion. The fault is created at secondary of T2 using fault block. Then secondary of X1 and X2 connect bus 2 through the measuring block.

Through these measuring blocks we can measure the instantaneous quantity of current and voltage. Bus 2 is provided into two parts bus A and bus B.

Bus A is connected the load on transformer 1 and interconnected with bus B.

Similarly bus B is directly attached to the load on the transformer 2 and interconnected with bus A. Grid connection of bus A and bus B is done through the CB 5. For Measuring power measuring block is provided to the transformers also scope ic attached to study the graph.

Graph of Active & Reactive power

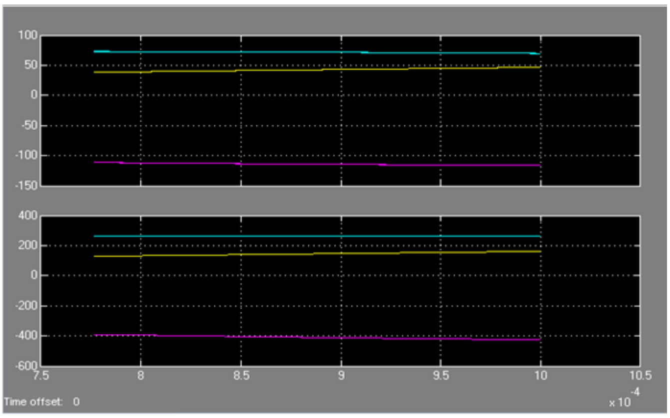


Figure 2. Description of graph Active & Reactive power

a) Active & Reactive power of X1
b) Active & Reactive power of X2

At t=0 sec tot=1 sec both the transformer feeding normal power. At t=1 sec when the fault is exist in system then True and Imaginary power of X1 get rise to upper value but when CB 5 get off then it start supplying normal load. After fault is cleared X2 again comes back and start supplying its normal load.

Actual graph of Real and Imaginary power of X1 & X2.

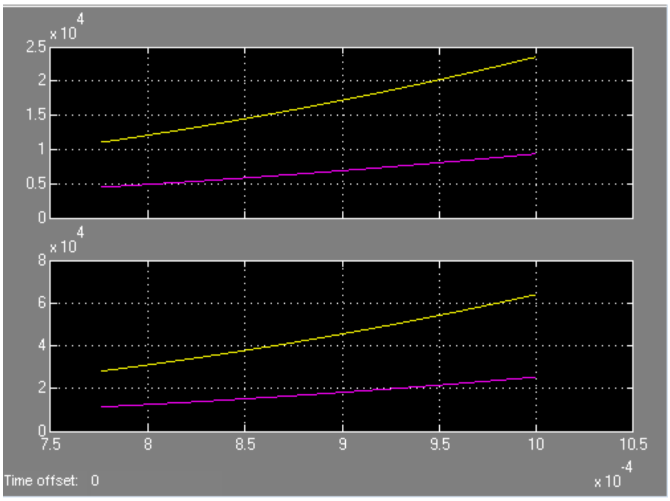


Figure 3. Graph Active & Reactive power

a) Active & Reactive power of normal transformer
b) Active & Reactive power of abnormal transformer

Timing instants and status of circuit breaker

SR. NO.	TIMING	STATUS OF CB
1	t=0sec to t=1sec	CB(1) CLOSE CB(2) CLOSE CB(3) CLOSE CB(4) CLOSE CB(5) CLOSE CB(6) CLOSE CB(7) CLOSE
2	t=1sec	FAULT CB(1) OPEN
3	t=1.01sec	CB(5) OPEN
4	t=2sec	FAULT REMOVE CB(1) CLOSE CB(5) CLOSE
5	t=2sec to t=2.3sec	TRASIENT EFFECT
6	t=2.3sec to t=10se	NORMAL OPERATION

Table 4. Timing instant and status of circuit breakers

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