CHAPTERT FOUR

4.0 ANALYSIS

Fault analysis was done by technical computer method using the theory of symmetrical components.The fault impedance Zf was taken as zero.

The following describes how the program codes that were developed for each type of fault were executed using a Matlab environment to generate results for the analysis:

4.0.1 LINE-GROUND FAULT

The program prompts the user to enter the faulted bus number and the fault impedance Zf. The prefault bus voltages are defined by the reserved Vector V. The array V may be defined or it is returned from the power flow programs lfgauss, lfnewton, decouple or perturb. If V does not exist the prefault bus voltages are automatically set to 1.0 per unit. The program obtains the total fault current, bus voltages and line currents during the fault.

4.0.2 LINE-LINE FAULT

The program prompts the user to enter the faulted bus number and the fault impedance Zf. The prefault bus voltages are defined by the reserved Vector V. The array V may be defined or it is returned from the power flow programs lfgauss, lfnewton, decouple or perturb. If V does not exist the prefault bus voltages are automatically set to 1.0 per unit. The program obtains the total fault current, bus voltages and line currents during the fault.

4.0.3 DOUBLE-LINE-GROUND FAULT

The program prompts the user to enter the faulted bus number and the fault impedance Zf. The prefault bus voltages are defined by the reserved Vector V. The array V may be defined or it is returned from the power flow programs lfgauss, lfnewton, decouple or perturb. If V does not exist the prefault bus voltages are automatically set to 1.0 per unit. The program obtains the total fault current, bus voltages and line currents during the fault.

4.0.4 SYMMETRICAL FAULT (BALANCED THREE - PHASE FAULT)

The program prompts the user to enter the faulted bus number and the fault impedance Zf. The prefault bus voltages are defined by the reserved Vector V. The array V may be defined or it is returned from the power flow programs lfgauss, lfnewton, decouple or perturb. If V does not exist the prefault bus voltages are automatically set to 1.0 per unit. The program obtains the total fault current, the postfault bus voltages and line currents.

4.1 Z BUILD CODE

The zero sequence impedances and the positive sequence impedances for the network were computed using the zbuild code where the positive and the negative sequence impedances were treated to be the same as indicated by the programs specifications.The network data for the various sequence impences i.e the sequence network of its thevenin's equivalent was obtained as below:

The above sequence network was the run using the zbuild code to form the complex bus impedance matrix by the method of building algorithm.

4.2 RESULTS

The following results were obtained after simulation of the codes using a matlab environment:

4.2.1 The complex bus impedance matrix

Zbus1 =

0 + 0.1450i	0 + 0.1050i	0 + 0.1300i
0 + 0.1050i	0 + 0.1450i	0 + 0.1200i
0 + 0.1300i	0 + 0.1200i	0 + 0.2200i

Zbus0 =

0 + 0.1820i	0 + 0.0545i	0 + 0.1400i
0 + 0.0545i	0 + 0.0864i	0 + 0.0650i
0 + 0.1400i	0 + 0.0650i	0 + 0.3500i

4.2.2 Line-to-ground fault analysis

Single line to-ground fault at bus No. 1

Total fault current = 6.3559 per unit

Bus Voltages during the fault in per unit

Bus -------Voltage Magnitude-------

No.	Phase a	Phase b	Phase c
1	0.0000	1.0414	1.0414
2	0.4396	0.9510	0.9510
3	0.1525	1.0108	1.0108

Line currents for fault at bus No. 1

From Bus	To Bus	-----Line Current Magnitude---- Phase a	Phase b	Phase c
1	F	6.3559	0.0000	0.0000
2	1	2.2564	0.2225	0.2225
2	3	0.6780	0.0424	0.0424
3	1	0.6780	0.0424	0.0424

Single line to-ground fault at bus No. 2

Total fault current = 7.9708 per unit

Bus Voltages during the fault in per unit

Bus No.	-------Voltage Magnitude------- Phase a	Phase b	Phase c
1	0.2972	0.9401	0.9401
2	0.0000	0.9319	0.9319
3	0.1896	0.9355	0.9355

Line currents for fault at bus No. 2

From Bus	To Bus	-----Line Current Magnitude---- Phase a	Phase b	Phase c
1	2	1.9827	0.5679	0.5679
1	3	0.6111	0.1860	0.1860
2	F	7.9708	0.0000	0.0000
3	2	0.6111	0.1860	0.1860

Single line to-ground fault at bus No. 3

Total fault current = 3.7975 per unit

Bus Voltages during the fault in per unit

Bus No.	-------Voltage Magnitude------- Phase a	Phase b	Phase c
1	0.4937	1.0064	1.0064
2	0.6139	0.9671	0.9671
3	0.0000	1.0916	1.0916

Line currents for fault at bus No. 3

From Bus	To Bus	-----Line Current Magnitude----