

Appendix A

Transmission Line Characteristics

From National Electricity Corporation (NEC) Sudan

Cont. (T.L Characteristics)

From Bus Name	To Bus Name	Circ. No.	Volt Kv	Length Km	Cond. ACSR	Line Parameters (+ve Circ.)			Line Rating MVA
						R	X	B	
MERINGAN	HAG ABDALLAH	1	110	35	95	0.10066	0.12178	0.01144	55
HAG-ABDALLAH	SENNAR P.S	1	110	60	95	0.02876	0.03479	0.00327	55
SENNAR P.S	SENNAR JUNC.	1	110	10	95	0.02876	0.03479	0.00327	55
SENNAR P.S	MINA SHARIF	1	110	65	95	0.13698	0.22132	0.02174	55
SENNAR JUNC.	RABAK	1	110	96	95	0.2761	0.33402	0.03139	180
SENNAR JUNC.	OMDURMAN	1	110	10	2X240	0.00554	0.02223	0.00498	180
KHARTOUM N.	FOREST	1	110	9.7	2X240	0.00537	0.02156	0.00483	180
OMDURMAN	MAGIRUS	1	110	11	2X240	0.00679	0.02445	0.00548	180
FOREST	MAGIRUS	1	110	10.9	2X240	0.00604	0.02423	0.00543	180
MAGIRUS	KILO X	1	110	145	120	0.30558	0.49372	0.04851	65 ✓
EL FAU	GEDAREF	1	66	38	95	0.30358	0.34633	0.00466	33
GEDAREF	RAWESDA	1	66	32	95	0.25565	0.29164	0.00392	33
RAWESDA	SHOWAK	1	66	70	95	0.55923	0.63797	0.00858	40
SHOWAK	KHASM EL GIRBA	1	66	95	120	0.55613	0.82656	0.01011	18
KHASM EL GIRBA	KASSALA	1	66	12.5	185	0.19628	0.47406	0.00043	24
BURRI	KILO X	1	33	3.4	300 Cu cable	0.02498	0.04184	0.00291	18
BURRI	KUKU	2	33	3.4	300 Cu cable	0.02498	0.04184	0.00291	18
BURRI	KUKU	3	33	3.4	300 Cu cable	0.02498	0.04184	0.00291	18
BURRI	KUKU	4	33	3.2	300 /120 AL cable	0.06336	0.343	0.00405	4.5
BURRI	KUKU	1	33	3.1	300 AL cable	0.02314	0.02179	0.00323	12
BURRI	SWST	1	33	3.5	301 AL cable	0.03857	0.3632	0.00539	12
BURRI	KUKU	1	33	3.5	301 AL cable	0.03857	0.3632	0.00539	12
SWST	KUKU	2	33	3.5	301 AL cable	0.07066	0.17066	0.00015	24
KUKU	KHARTOUM N.	1	33	4.5	185	0.07066	0.17066	0.00015	24
KUKU	KHARTOUM N.	2	33	4.5	185	0.07066	0.17066	0.00015	24

ANNALX96.XLS

T.L characteristics

A) 220 K V Line Conduoter Specification

Conductor Specification							Q.T.Y
Type Acsr 400 AL 54/3.18 mm Steel 7/3.18 mm							
Over All Diameter28.62 mm							
Nominal X- Sectional Area258.1 mm							
Conductor weight 1.619K.g /M							
THE LINE PARAMETERS ARE SHOWN IN TABLE (1)							
R 1	R0	X 1	X0	Y1	Y0	1 MAX	
0.06865	0.5054	0.4247	1.4247	2.8337	1.3823	851	

EARTH WIRE

Type Galvanized Steel..... 19/2.34 mm
 Over All Dimeter 11.88 mm
 Cross- sectional Area 82.28 mm
 Weight 0.67 kg/m

B) 110 K V Line Conduoter Specification

Conductor Specification							Q.T.Y
Type Acsr 125/30 AL30/2.33 mm Steel 29.85 mm							
Over All Diameter16.30 mm							
Nominal X- Sectional Area 127.92 mm							
Conductor weight 0583 k.g /M							
THE LINE PARAMETERS ARE SHOWN IN TABLE (2)							
R 1	R0	X 1	X0	Y1	Y0	1 MAX	
0.225	0.452	0.370	1.370	2.7646	1.7122	396	

EARTH WIRE

Type Galvanized Steel
 Number and diamete of steel strands 7/2m
 Over All Dimeter9.0 mm
 Cross- sectional Area 49.48 mm
 Weight 0.391 kg/m

SENNAR - RABAK AND SENNAR BURRILINES

Type ACSR 95

CONDUCTOR PARAMETERS IN TABLE (3)

R 1	R0	X 1	X0	Y1	Y0	1 MAX
0.348	0.452	0.431	1.370	2.7018	1.722	324

Appendix B

Matlab Program Code

Line to ground fault program .1

program code to simulate line to ground fault %

```
zdata1=input('please enter line parameters (negative
              '['sequence impedance) in matrix form [X0 X1 X2
zdata0=input('please enter line parameters in (zero sequence
              '['impedance) in matrix form [X0 X1 X2
zdata2=zdata1; % zdata2 is a positive sequence impedance
              (zbus1=zbuild(zdata1
              (zbus0=zbuild(zdata0
              zbus2=zbus1
(lgfault(zdata0,zbus0,zdata1,zbus1,zdata2,zbus2
```

Line to line fault program .2

program code to simulate line to line (LL) fault %

```
zdata1=input('please enter line parameters (negative
              '['sequence impedance) in matrix form [X0 X1 X2
zdata0=input('please enter line parameters in (zero sequence
              '['impedance) in matrix form [X0 X1 X2
zdata2=zdata1; % zdata2 is a positive sequence impedance
```

```

(zbus1=zbuild(zdata1
(zbus0=zbuild(zdata0
zbus2=zbus1
(llgfault(zdata0,zbus0,zdata1,zbus1,zdata2,zbus2

```

Line to line to ground fault program .3

program code to simulate line to line to ground (LLG) fault %

```

zdata1=input('please enter line parameters (negative
(['sequence impedance) in matrix form [X0 X1 X2
zdata0=input('please enter line parameters in (zero sequence
(['impedance) in matrix form [X0 X1 X2
zdata2=zdata1; % zdata2 is a positive sequence impedance
(zbus1=zbuild(zdata1
(zbus0=zbuild(zdata0
zbus2=zbus1
(dlgfault(zdata0,zbus0,zdata1,zbus1,zdata2,zbus2

```

Appendix C

The data set for Training and Testing Neural Networks

	Detection Network Training Data						
	Desired Output	Input vector for Detection Network					
Fault Type	(Output (S	Ic	Ib	Ia	Vc	Vb	Va
I _g	1	0.9791	0.9814	3.3345	1.1722	1.1937	0.3335
I _g	1	0.9654	0.9783	3.2306	1.168	1.1851	0.3554
I _g	1	0.9814	3.3345	0.9791	1.1937	0.3335	1.1722
I _g	1	0.9783	3.2306	0.9654	1.1851	0.3554	1.168
I _g	1	3.3345	0.9791	0.9814	0.3335	1.1722	1.1937
I _g	1	3.2306	0.9654	0.9783	0.3554	1.168	1.1851
I _l	1	5.3791	5.3791	0.9834	0.6501	0.4713	1.1878
I _l	1	5.0847	5.0847	0.9891	0.6712	0.4854	1.1738
I _l	1	5.3791	0.9834	5.3791	0.4713	1	0.6501
I _l	1	5.0847	0.9891	5.0847	0.4854	1	0.6712
I _l	1	0.9834	5.3791	5.3791	1	0.6501	0.4713
I _l	1	0.9891	5.0847	5.0847	1	0.6712	0.4854
I _{lg}	1	7.8554	7.1872	0.9851	0.2045	0.2045	1.1878
I _{lg}	1	7.8354	7.1884	0.9871	0.2272	0.2272	1.1738
I _{lg}	1	7.1872	0.9851	7.8554	0.2045	1.1878	0.2045
I _{lg}	1	7.1884	0.9871	7.8354	0.2272	1.1738	0.2272
I _{lg}	1	0.9851	7.8554	7.1872	1.1878	0.2045	0.2045
I _{lg}	1	0.9871	7.8354	7.1884	1.1738	0.2272	0.2272
No Fault	0	0.9851	0.9791	0.9868	0.9791	0.9791	0.9868
No Fault	0	0.9871	0.9654	0.9901	0.9654	0.9654	0.9901

No Fault	0	0.9851	0.9814	0.9876	0.9814	0.9814	0.9876
No Fault	0	0.9791	0.9783	0.9791	0.9783	0.9783	0.9791
No Fault	0	0.9654	0.9791	0.9654	0.9791	0.9791	0.9654
No Fault	0	0.9814	0.9654	0.9814	0.9654	0.9654	0.9814
No Fault	0	0.9783	0.9814	0.9783	0.9542	0.9814	0.9783
No Fault	0	0.9891	0.9783	0.9834	0.9773	0.9783	0.9791
No Fault	0	0.9871	0.9791	0.9891	0.9791	0.9868	0.9654
No Fault	0	0.9879	0.9654	0.9823	0.9654	0.9901	0.9542
No Fault	0	0.9905	0.9542	0.9945	0.9542	0.9876	0.9773
No Fault	0	0.9891	0.9773	0.9834	0.9773	0.9868	0.9791
No Fault	0	0.9871	0.9791	0.9891	0.9868	0.9901	0.9654
No Fault	0	0.9879	0.9654	0.9823	0.9901	0.9876	0.9542
No Fault	0	0.9901	0.9542	0.9945	0.9876	0.9773	0.9773
No Fault	0	0.9901	0.9773	0.9834	0.9901	0.9868	0.9901

Classification Network Training Data										
Fault Type	Desired Output				Input vector for Classification Network					
	G	C	B	A	Ic	Ib	Ia	Vc	Vb	Va
lg	1	0	0	1	0.9791	0.9814 4	3.334 5	1.1722	1.193 7	0.333 5
lg	1	0	0	1	0.9654	0.9783 3	3.230 6	1.168	1.185 1	0.355 4
lg	1	0	0	1	0.9542	0.9643 3	3.132 8	1.1639	1.177 2	0.375 9
lg	1	0	0	1	0.9773	0.9876 1	3.040 5	1.16	1.169 8	0.395 3
lg	1	0	0	1	0.9861	0.9923 3	2.953 3	1.1563	1.162 9	0.413 5
lg	1	0	0	1	0.9872	0.9891 2	2.870 9	1.1527	1.156 4	0.430 6
lg	1	0	0	1	0.9761	0.9851 4	2.792 8	1.1493	1.150 4	0.446 9
lg	1	0	0	1	0.9695	0.9761 5	2.718 8	1.146	1.144 8	0.462 2
lg	1	0	0	1	0.9765	0.9823 3	2.648 5	1.1428	1.139 5	0.476 7
lg	1	0	1	0	0.9814	3.334 5	0.979 1	1.1937	0.333 5	1.172 2
lg	1	0	1	0	0.9783	3.230 6	0.965 4	1.1851	0.355 4	1.168
lg	1	0	1	0	0.9643	3.132 8	0.954 2	1.1772	0.375 9	1.163 9
lg	1	0	1	0	0.9871	3.040 5	0.977 3	1.1698	0.395 3	1.16
lg	1	0	1	0	0.9923	2.953 3	0.986	1.1629	0.413	1.156

						3	1		5	3
lg	1	0	1	0	0.9892	2.870 9	0.987 2	1.1564	0.430 6	1.152 7
lg	1	0	1	0	0.9854	2.792 8	0.976 1	1.1504	0.446 9	1.149 3
lg	1	0	1	0	0.9765	2.718 8	0.969 5	1.1448	0.462 2	1.146
lg	1	0	1	0	0.9823	2.648 5	0.976 5	1.1395	0.476 7	1.142 8
lg	1	1	0	0	3.3345	0.979 1	0.981 4	0.3335	1.172 2	1.193 7
lg	1	1	0	0	3.2306	0.965 4	0.978 3	0.3554	1.168	1.185 1
lg	1	1	0	0	3.1328	0.954 2	0.964 3	0.3759	1.163 9	1.177 2
lg	1	1	0	0	3.0405	0.977 3	0.987 1	0.3953	1.16	1.169 8
lg	1	1	0	0	2.9533	0.986 1	0.992 3	0.4135	1.156 3	1.162 9
lg	1	1	0	0	2.8709	0.987 2	0.989 2	0.4306	1.152 7	1.156 4
lg	1	1	0	0	2.7928	0.976 1	0.985 4	0.4469	1.149 3	1.150 4
lg	1	1	0	0	2.7188	0.969 5	0.976 5	0.4622	1.146	1.144 8
lg	1	1	0	0	2.6485	0.976 5	0.982 3	0.4767	1.142 8	1.139 5
ll	0	1	1	0	5.3791	5.379 1	0.983 4	0.6501	0.471 3	1
ll	0	1	1	0	5.0847	5.084 7	0.989 1	0.6712	0.485 4	1
ll	0	1	1	0	4.819	4.819	0.982 3	0.6902	0.501 2	1
ll	0	1	1	0	4.5781	4.578 1	0.994 5	0.7073	0.517 7	1
ll	0	1	1	0	4.359	4.359	0.987 3	0.7228	0.534 3	1
ll	0	1	1	0	4.1591	4.159 1	0.987 6	0.7368	0.550 6	1
ll	0	1	1	0	3.9758	3.975 8	0.986 8	0.7495	0.566 4	1
ll	0	1	1	0	3.8074	3.807 4	0.990 1	0.7611	0.581 6	1
ll	0	1	1	0	3.6523	3.652 3	0.987 6	0.7717	0.596 1	1
ll	0	1	0	1	5.3791	0.983 4	5.379 1	0.4713	1	0.650 1
ll	0	1	0	1	5.0847	0.989 1	5.084 7	0.4854	1	0.671 2
ll	0	1	0	1	4.819	0.982 3	4.819	0.5012	1	0.690 2
ll	0	1	0	1	4.5781	0.994 5	4.578 1	0.5177	1	0.707 3
ll	0	1	0	1	4.359	0.987 3	4.359	0.5343	1	0.722 8
ll	0	1	0	1	4.1591	0.987 1	4.159	0.5506	1	0.736

						6	1			8
II	0	1	0	1	3.9758	0.9868	3.9758	0.5664	1	0.7495
II	0	1	0	1	3.8074	0.9901	3.8074	0.5816	1	0.7611
II	0	1	0	1	3.6523	0.9876	3.6523	0.5961	1	0.7717
II	0	0	1	1	0.9834	5.3791	5.3791	1	0.6501	0.4713
II	0	0	1	1	0.9891	5.0847	5.0847	1	0.6712	0.4854
II	0	0	1	1	0.9823	4.819	4.819	1	0.6902	0.5012
II	0	0	1	1	0.9945	4.5781	4.5781	1	0.7073	0.5177
II	0	0	1	1	0.9873	4.359	4.359	1	0.7228	0.5343
II	0	0	1	1	0.9876	4.1591	4.1591	1	0.7368	0.5506
II	0	0	1	1	0.9868	3.9758	3.9758	1	0.7495	0.5664
II	0	0	1	1	0.9901	3.8074	3.8074	1	0.7611	0.5816
II	0	0	1	1	0.9876	3.6523	3.6523	1	0.7717	0.5961
IIg	1	1	1	0	7.8554	7.1872	0.9851	0.2045	0.2045	1.1878
IIg	1	1	1	0	7.8354	7.1884	0.9871	0.2272	0.2272	1.1738
IIg	1	1	1	0	7.8167	7.1921	0.9891	0.2467	0.2467	1.1617
IIg	1	1	1	0	7.7996	7.1971	0.9871	0.2636	0.2636	1.1511
IIg	1	1	1	0	7.8381	7.2031	0.9879	0.2785	0.2785	1.1418
IIg	1	1	1	0	7.7692	7.2094	0.9905	0.2916	0.2916	1.1335
IIg	1	1	1	0	7.7558	7.2161	0.9865	0.3032	0.3032	1.1262
IIg	1	1	1	0	7.7434	7.2227	0.9872	0.3137	0.3137	1.1196
IIg	1	1	1	0	7.7319	7.2293	0.9871	0.3231	0.3231	1.1136
IIg	1	1	0	1	7.1872	0.9851	7.8554	0.2045	1.1878	0.2045
IIg	1	1	0	1	7.1884	0.9871	7.8354	0.2272	1.1738	0.2272
IIg	1	1	0	1	7.1921	0.9891	7.8167	0.2467	1.1617	0.2467
IIg	1	1	0	1	7.1971	0.9871	7.7996	0.2636	1.1511	0.2636
IIg	1	1	0	1	7.2031	0.9879	7.8381	0.2785	1.1418	0.2785
IIg	1	1	0	1	7.2094	0.9905	7.7692	0.2916	1.1335	0.2916
IIg	1	1	0	1	7.2161	0.9865	7.7558	0.3032	1.1262	0.3032

						5	8		2	2
llg	1	1	0	1	7.2227	0.9872	7.7434	0.3137	1.1196	0.3137
llg	1	1	0	1	7.2293	0.9871	7.7319	0.3231	1.1136	0.3231
llg	1	0	1	1	0.9851	7.8554	7.1872	1.1878	0.2045	0.2045
llg	1	0	1	1	0.9871	7.8354	7.1884	1.1738	0.2272	0.2272
llg	1	0	1	1	0.9891	7.8167	7.1921	1.1617	0.2467	0.2467
llg	1	0	1	1	0.9871	7.7996	7.1971	1.1511	0.2636	0.2636
llg	1	0	1	1	0.9879	7.8381	7.2031	1.1418	0.2785	0.2785
llg	1	0	1	1	0.9905	7.7692	7.2094	1.1335	0.2916	0.2916
llg	1	0	1	1	0.9865	7.7558	7.2161	1.1262	0.3032	0.3032
llg	1	0	1	1	0.9872	7.7434	7.2227	1.1196	0.3137	0.3137
llg	1	0	1	1	0.9871	7.7319	7.2293	1.1136	0.3231	0.3231

	Isolation Network Training Data								
	Desired Output			Input vector for Isolation Network					
Zone	Z3	Z2	Z1	Ic	Ib	Ia	Vc	Vb	Va
Zone 1	0	0	1	0.9791	0.9814	3.3345	1.1722	1.1937	0.3335
Zone 1	0	0	1	0.9654	0.9783	3.2306	1.168	1.1851	0.3554
Zone 1	0	0	1	0.9542	0.9643	3.1328	1.1639	1.1772	0.3759
Zone 1	0	0	1	0.9814	3.3345	0.9791	1.1937	0.3335	1.1722
Zone 1	0	0	1	0.9783	3.2306	0.9654	1.1851	0.3554	1.168
Zone 1	0	0	1	0.9643	3.1328	0.9542	1.1772	0.3759	1.1639
Zone 1	0	0	1	3.3345	0.9791	0.9814	0.3335	1.1722	1.1937
Zone 1	0	0	1	3.2306	0.9654	0.9783	0.3554	1.168	1.1851
Zone 1	0	0	1	3.1328	0.9542	0.9643	0.3759	1.1639	1.1772
Zone 2	0	1	0	0.9892	0.9872	2.1927	1.1215	1.107	0.5701
Zone 2	0	1	0	0.9854	0.9761	2.1019	1.1171	1.1009	0.5885

Zone 2	0	1	0	0.9765	0.9695	2.0182	1.113	1.0954	0.6055
Zone 2	0	1	0	0.9872	2.1927	0.9892	1.107	0.5701	1.1215
Zone 2	0	1	0	0.9761	2.1019	0.9854	1.1009	0.5885	1.1171
Zone 2	0	1	0	0.9695	2.0182	0.9765	1.0954	0.6055	1.113
Zone 2	0	1	0	2.1927	0.9892	0.9872	0.5701	1.1215	1.107
Zone 2	0	1	0	2.1019	0.9854	0.9761	0.5885	1.1171	1.1009
Zone 2	0	1	0	2.0182	0.9765	0.9695	0.6055	1.113	1.0954
Zone 3	1	0	0	0.9765	0.9823	1.4418	1.0834	1.0605	0.7209
Zone 3	1	0	0	0.9892	0.9892	1.4016	1.0812	1.0582	0.7288
Zone 3	1	0	0	0.9854	0.9854	1.3636	1.0792	1.0562	0.7364
Zone 3	1	0	0	0.9823	1.4418	0.9765	1.0605	0.7209	1.0834
Zone 3	1	0	0	0.9892	1.4016	0.9892	1.0582	0.7288	1.0812
Zone 3	1	0	0	0.9854	1.3636	0.9854	1.0562	0.7364	1.0792
Zone 3	1	0	0	1.4418	0.9765	0.9823	0.7209	1.0834	1.0605
Zone 3	1	0	0	1.4016	0.9892	0.9892	0.7288	1.0812	1.0582
Zone 3	1	0	0	1.3636	0.9854	0.9854	0.7364	1.0792	1.0562
Zone 1	0	0	1	5.3791	5.3791	0.9834	0.6501	0.4713	1
Zone 1	0	0	1	5.0847	5.0847	0.9891	0.6712	0.4854	1
Zone 1	0	0	1	4.819	4.819	0.9823	0.6902	0.5012	1
Zone 1	0	0	1	5.3791	0.9834	5.3791	0.4713	1	0.6501
Zone 1	0	0	1	5.0847	0.9891	5.0847	0.4854	1	0.6712
Zone 1	0	0	1	4.819	0.9823	4.819	0.5012	1	0.6902
Zone 1	0	0	1	0.9834	5.3791	5.3791	1	0.6501	0.4713
Zone 1	0	0	1	0.9891	5.0847	5.0847	1	0.6712	0.4854
Zone 1	0	0	1	0.9823	4.819	4.819	1	0.6902	0.5012
Zone 2	0	1	0	3.8074	3.8074	0.9901	0.7611	0.5816	1
Zone 2	0	1	0	3.6523	3.6523	0.9876	0.7717	0.5961	1
Zone 2	0	1	0	3.5091	3.5091	0.9874	0.7815	0.6098	1
Zone 2	0	1	0	3.8074	0.9901	3.8074	0.5816	1	0.7611
Zone 2	0	1	0	3.6523	0.9876	3.6523	0.5961	1	0.7717
Zone 2	0	1	0	3.5091	0.9874	3.5091	0.6098	1	0.7815
Zone 2	0	1	0	0.9901	3.8074	3.8074	1	0.7611	0.5816
Zone 2	0	1	0	0.9876	3.6523	3.6523	1	0.7717	0.5961
Zone 2	0	1	0	0.9874	3.5091	3.5091	1	0.7815	0.6098
Zone 3	1	0	0	2.6251	2.6251	0.9854	0.8404	0.7011	1
Zone 3	1	0	0	2.5127	2.5127	0.9967	0.8477	0.7132	1
Zone 3	1	0	0	2.4429	2.4429	0.9854	0.8523	0.7208	1
Zone 3	1	0	0	2.6251	0.9854	2.6251	0.7011	1	0.8404
Zone 3	1	0	0	2.5127	0.9967	2.5127	0.7132	1	0.8477
Zone 3	1	0	0	2.4429	0.9854	2.4429	0.7208	1	0.8523
Zone 3	1	0	0	0.9854	2.6251	2.6251	1	0.8404	0.7011
Zone 3	1	0	0	0.9967	2.5127	2.5127	1	0.8477	0.7132
Zone 3	1	0	0	0.9854	2.4429	2.4429	1	0.8523	0.7208
Zone 1	0	0	1	7.8554	7.1872	0.9851	0.2045	0.2045	1.1878
Zone 1	0	0	1	7.8354	7.1884	0.9871	0.2272	0.2272	1.1738
Zone 1	0	0	1	7.8167	7.1921	0.9891	0.2467	0.2467	1.1617
Zone 1	0	0	1	7.1872	0.9851	7.8554	0.2045	1.1878	0.2045
Zone 1	0	0	1	7.1884	0.9871	7.8354	0.2272	1.1738	0.2272
Zone 1	0	0	1	7.1921	0.9891	7.8167	0.2467	1.1617	0.2467
Zone 1	0	0	1	0.9851	7.8554	7.1872	1.1878	0.2045	0.2045
Zone 1	0	0	1	0.9871	7.8354	7.1884	1.1738	0.2272	0.2272

Zone 1	0	0	1	0.9891	7.8167	7.1921	1.1617	0.2467	0.2467
Zone 2	0	1	0	2.6263	2.3931	0.9986	0.1572	0.1572	1.2164
Zone 2	0	1	0	2.6031	2.3915	0.9789	0.2405	0.2405	1.1654
Zone 2	0	1	0	2.5852	2.3979	0.9854	0.2916	0.2916	1.1335
Zone 2	0	1	0	2.3931	0.9986	2.6263	0.1572	1.2164	0.1572
Zone 2	0	1	0	2.3915	0.9789	2.6031	0.2405	1.1654	0.2405
Zone 2	0	1	0	2.3979	0.9854	2.5852	0.2916	1.1335	0.2916
Zone 2	0	1	0	0.9986	2.6263	2.3931	1.2164	0.1572	0.1572
Zone 2	0	1	0	0.9789	2.6031	2.3915	1.1654	0.2405	0.2405
Zone 2	0	1	0	0.9854	2.5852	2.3979	1.1335	0.2916	0.2916
Zone 3	1	0	0	1.3425	1.2229	0.9987	0.0941	0.0941	1.2542
Zone 3	1	0	0	1.3359	1.2173	0.9875	0.1591	0.1591	1.2154
Zone 3	1	0	0	1.3296	1.2161	0.9768	0.2066	0.2066	1.1865
Zone 3	1	0	0	1.2229	0.9987	1.3425	0.0941	1.2542	0.0941
Zone 3	1	0	0	1.2173	0.9875	1.3359	0.1591	1.2154	0.1591
Zone 3	1	0	0	1.2161	0.9768	1.3296	0.2066	1.1865	0.2066
Zone 3	1	0	0	0.9987	1.3425	1.2229	1.2542	0.0941	0.0941
Zone 3	1	0	0	0.9875	1.3359	1.2173	1.2154	0.1591	0.1591
Zone 3	1	0	0	0.9768	1.3296	1.2161	1.1865	0.2066	0.2066

Isolation Network Test Data									
Zone	Desired Output			Input vector for Isolation Network					
	Z3	Z2	Z1	Ic	Ib	Ia	Vc	Vb	Va
Zone 1	0	0	1	0.9773	0.9871	3.0405	1.16	1.1698	0.3953
Zone 1	0	0	1	0.9861	0.9923	2.9533	1.1563	1.1629	0.4135
Zone 1	0	0	1	0.9871	3.0405	0.9773	1.1698	0.3953	1.16
Zone 1	0	0	1	0.9923	2.9533	0.9861	1.1629	0.4135	1.1563
Zone 2	0	1	0	0.9854	0.9761	2.1019	1.1171	1.1009	0.5885
Zone 2	0	1	0	0.9765	0.9695	2.0182	1.113	1.0954	0.6055
Zone 2	0	1	0	2.1019	0.9854	0.9761	0.5885	1.1171	1.1009
Zone 2	0	1	0	2.0182	0.9765	0.9695	0.6055	1.113	1.0954
Zone 3	1	0	0	0.9695	0.9765	1.4843	1.0856	1.0629	0.7124
Zone 3	1	0	0	0.9765	0.9823	1.4418	1.0834	1.0605	0.7209
Zone 3	1	0	0	0.9765	1.4843	0.9695	1.0629	0.7124	1.0856
Zone 3	1	0	0	0.9823	1.4418	0.9765	1.0605	0.7209	1.0834
Zone 1	0	0	1	5.0847	5.0847	0.9891	0.6712	0.4854	1

Zone 1	0	0	1	4.819	4.819	0.9823	0.6902	0.5012	1
Zone 1	0	0	1	5.0847	0.9891	5.0847	0.4854	1	0.6712
Zone 1	0	0	1	4.819	0.9823	4.819	0.5012	1	0.6902
Zone 2	0	1	0	3.6523	3.6523	0.9876	0.7717	0.5961	1
Zone 2	0	1	0	3.5091	3.5091	0.9874	0.7815	0.6098	1
Zone 2	0	1	0	0.9876	3.6523	3.6523	1	0.7717	0.5961
Zone 2	0	1	0	0.9874	3.5091	3.5091	1	0.7815	0.6098
Zone 3	1	0	0	2.5127	2.5127	0.9967	0.8477	0.7132	1
Zone 3	1	0	0	2.4429	2.4429	0.9854	0.8523	0.7208	1
Zone 3	1	0	0	2.5127	0.9967	2.5127	0.7132	1	0.8477
Zone 3	1	0	0	2.4429	0.9854	2.4429	0.7208	1	0.8523
Zone 1	0	0	1	7.7996	7.1971	0.9871	0.2636	0.2636	1.1511
Zone 1	0	0	1	7.8381	7.2031	0.9879	0.2785	0.2785	1.1418
Zone 1	0	0	1	0.9871	7.7996	7.1971	1.1511	0.2636	0.2636
Zone 1	0	0	1	0.9879	7.8381	7.2031	1.1418	0.2785	0.2785
Zone 2	0	1	0	2.6031	2.3915	0.9789	0.2405	0.2405	1.1654
Zone 2	0	1	0	2.5852	2.3979	0.9854	0.2916	0.2916	1.1335
Zone 2	0	1	0	2.3915	0.9789	2.6031	0.2405	1.1654	0.2405
Zone 2	0	1	0	2.3979	0.9854	2.5852	0.2916	1.1335	0.2916
Zone 3	1	0	0	1.3359	1.2173	0.9875	0.1591	0.1591	1.2154
Zone 3	1	0	0	1.3296	1.2161	0.9768	0.2066	0.2066	1.1865
Zone 3	1	0	0	1.2173	0.9875	1.3359	0.1591	1.2154	0.1591
Zone 3	1	0	0	1.2161	0.9768	1.3296	0.2066		0.2066

Detection and Classification Network Test Data						
Input vector for Detection and Classification Network						
Fault Type	Ic	Ib	Ia	Vc	Vb	Va
Ig	0.9861	0.9923	2.9533	1.1563	1.1629	0.4135
Ig	0.9872	0.9892	2.8709	1.1527	1.1564	0.4306
Ig	0.9761	0.9854	2.7928	1.1493	1.1504	0.4469
Ig	0.9923	2.9533	0.9861	1.1629	0.4135	1.1563
Ig	0.9892	2.8709	0.9872	1.1564	0.4306	1.1527
Ig	0.9854	2.7928	0.9761	1.1504	0.4469	1.1493
Ig	2.9533	0.9861	0.9923	0.4135	1.1563	1.1629
Ig	2.8709	0.9872	0.9892	0.4306	1.1527	1.1564
Ig	2.7928	0.9761	0.9854	0.4469	1.1493	1.1504
II	4.5781	4.5781	0.9945	0.7073	0.5177	0.9834
II	4.359	4.359	0.9873	0.7228	0.5343	0.9891
II	4.1591	4.1591	0.9876	0.7368	0.5506	0.9823

II	4.5781	0.9945	4.5781	0.5177	0.9834	0.7073
II	4.359	0.9873	4.359	0.5343	0.9891	0.7228
II	4.1591	0.9876	4.1591	0.5506	0.9823	0.7368
II	0.9945	4.5781	4.5781	0.9834	0.7073	0.5177
II	0.9873	4.359	4.359	0.9891	0.7228	0.5343
II	0.9876	4.1591	4.1591	0.9823	0.7368	0.5506
IIg	7.7996	7.1971	0.9871	0.2636	0.2636	1.1511
IIg	7.8381	7.2031	0.9879	0.2785	0.2785	1.1418
IIg	7.7692	7.2094	0.9905	0.2916	0.2916	1.1335
IIg	7.1971	0.9871	7.7996	0.2636	1.1511	0.2636
IIg	7.2031	0.9879	7.8381	0.2785	1.1418	0.2785
IIg	7.2094	0.9905	7.7692	0.2916	1.1335	0.2916
IIg	0.9871	7.7996	7.1971	1.1511	0.2636	0.2636
IIg	0.9879	7.8381	7.2031	1.1418	0.2785	0.2785
IIg	0.9905	7.7692	7.2094	1.1335	0.2916	0.2916
No Fault	0.9834	0.9868	0.9891	0.9891	0.9891	0.9871
No Fault	0.9891	0.9901	0.9854	0.9871	0.9854	0.9938
No Fault	0.9823	0.9876	0.9967	0.9879	0.9967	0.9871
No Fault	0.9834	0.9868	0.9891	0.9891	0.9891	0.9871
No Fault	0.9891	0.9901	0.9854	0.9871	0.9854	0.9938
No Fault	0.9823	0.9876	0.9967	0.9879	0.9967	0.9871