Short Circuit Analysis for Power System – A Program installed at RCC, Calcutta."

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SHORT CIRCUIT ANALYSIS FOR POWER SYSTEM A PROGRAM INSTALLED AT RCC, CALCUTTA

Sushil Kumar Soonee
Eastern Regional Electricity Board
Regional Load Despatching Centre
Calcutta

INTRODUCTION :

This is a general program for analysing the behaviour of Power Systems under faulted condition. it takes care of both three phase dead short circuit and single line to ground fault.

OBJECT :

Such a study after analysis can help in determining the following :

i) To estimate fault current
ii) To check circuit breaker capacity
iii) To check the rise in voltage during single line to ground fault
iv) To find residual voltage and according set relay settings
v) To find interference because of power line, etc.

INPUT :

The program requires following as input data :

1. No. of stations (Buses)
2. No. of elements in total i. e.
   i) No. of generators
   ii) No. of lines
   iii) No. of transformers, etc.
   iv) Element data i. e. generator data, line data, transformer data etc. at 100 MVA base.
   v) Name of each bus.

OUTPUT :

The result contains the following :

1. Fault MVA at faulted bus (for three phase as well as single line to ground fault)
2. Fault current at faulted bus
3. Fault MVA contribution from neighbouring buses (for both cases)
4. Fault current contribution from neighbouring buses
5. Driving point, positive sequence impedance for faulted bus.
6. Driving point zero sequence impedance for faulted buses.
7. Voltage at neighbouring buses during three phase fault.
8. Sequence and magnitude voltages for healthy phases of the faulted buses during single line to ground fault.
9. Sequence and magnitude voltages for buses adjacent to faulted bus for both three phase as well as single line to ground fault.
10. Residual voltage during single line to ground fault.
11. Ratio of driving point impedence, fault MVA, etc.

ALGORITHM :

1. Acceptance of input data in an unordered fashion.
2. Arranging data in order.
3. Formation of Bus impedance matrix (ZBUS) for positive sequence.
4. Formation of bus impedance matrix for zero sequence.
5. Calculation of output variables.
6. Output printing.

MODELLING :

Programs using rigorous models with complex variables have been tried by the author and it was found that improvement in resuit is not significant where as the computation requirement increases significantly.

Hence lines are represented as a simple reactance. Generators can be represented by either transient or subtransient reactance. Two winding transformers are also represented by their reactance. Three winding transformers are represented by a π equivalent. All shunt connections are neglected as they do not contribute to fault.

FORMAT (INPUT) :

1st Card reads : Title of the study FORMAT (20A4)

2nd Card reads : No. of buses and no. of elements.
Elements include all i. e. Generator, line transformer etc.
READ NBUS, NLINE
FORMAT (213)

Data set : —Element data
READ, NF, NT, ZI, ZO
FORMAT (213, 2F6.2)

where
NF=FROM BUS
NT=TO BUS
ZI=Positive sequence reactance
ZO=Zero sequence reactance

There is no restriction on the order of element data. NF and NT can be selected either way. Elements connected to ground should have "O" (Zero) as one of the buses i. e. Bus O (Zero) is taken as reference bus.

SAMPLE JOB DECK

EXAMPLE

< > BEGIN JOB RCC/077 ; CLASS=2
< > USER=RCCCOURSE/XXX
< > RUN (RLDCEREBCEA)EREB/SOONEE/FAULT ; DATA
(One card giving title of the study)
(One Card containing NBUS, NLINE)
(Set of Card giving name of the Buses : No. of Card=NBUS/20)
(Set of Element Data ; No. of Cards=NLINE)
< > END
< > END JOB

PROCESS & I/O TIME

This program has been developed and used at Regional Load Despatching Centre for carrying out fault study of Eastern Grid. The power system of Orissa State Electricity Board, Bihar State Electricity Board, Damodar Valley Corporation, West Bengal State Electricity Board, Durgapur Projects Limited and Calcutta Electric Supply Corporation in integration along with connection to Northern Region in Uttar Pradesh and to Southern Region in Andhra Pradesh. The total system was restricted to 91 buses and 140 elements. Process time taken was 75 secs. and I/O time taken was approx. 10 secs.

The program was also used for special study of Demodar Valley Corporation. The program was also being used by Northern Regional Electricity Board for the fault study of Northern Region.

LIMITATIONS :

There is no limitation on numbering of buses and order in which data should be given, however, separated system should not be given. Normally to save computation time radial buses should be avoided, although the program puts no restriction on this.

Maximum number of 200 Buses can be considered which is practicall .io limitation.

Mutual impedance has not been considered, hence user should iump the mutual impedances, if any.

In case only three phases fault study is desired or the zero sequence data is not available, zero sequence data could be omitted i.e. don't give zero sequence data. The output in such cases will only give three phase fault results.

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FEEDBACK :

Any comments and suggestion on the algorithm and program will be highly welcome. Any problems encored in connection with the execution of the program may please be reported to the author which will defnitely receive due attention.

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