

## **EXPERIMENT NO 1**

### **OBJECTIVE**

To compute the fault level, post-fault voltages and currents for different types of faults.

### **SOFTWARE USED**

MATLAB

### **THEORY**

During fault the system must be protected against the flow of heavy short circuit currents (which can cause permanent damage to major equipment) by disconnecting the faulty part of the system by means of circuit breakers operated by protective relaying. For proper choice of circuit breakers and protective relaying, we must estimate the magnitude of currents that would flow under short circuit conditions, which is the scope of fault analysis.

The majority of the System faults are not three-phase faults but faults involving one line to ground or occasionally two lines to ground. These are unsymmetrical faults requiring special tools like symmetrical components. Though the symmetrical faults are rare, the symmetrical fault analysis must be carried out, as this type of fault generally leads to most severe fault current flow against which the system must be protected.

#### *Symmetrical Fault calculation*

Apply Thevenin's equivalent circuit to calculate the fault current.

Fault current,  $I_f = V_{th} / Z_{th}$

Where,  $V_{th}$  = Thevenin's Voltage across the fault

$Z_{th}$  = Thevenin's Impedance across the fault

### **PROBLEM STATEMENT**

The one line diagram for simple three bus power system is shown in figure 1. Each generator is represented by an emf behind the transient reactance. All impedances are expressed in per unit on a common 100 MVA base and for simplicity resistance is neglected. The following assumptions are made:

- I. Shunt capacitances are neglected & the system is considered on no-load.
- II. All generators are running at their rated voltage and rated frequency with their emf's in phase.

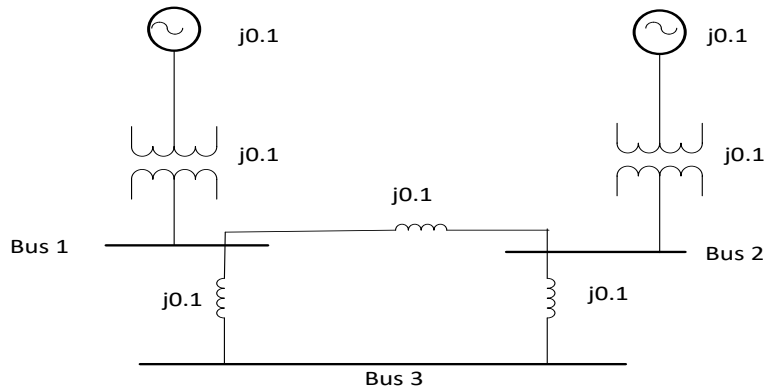


Fig: 1

Determine the fault current, the bus voltages & line currents during the fault when a balanced three phase fault with fault impedance  $Z_f = 0.16$  pu occurs on

- A . Bus 3
- B . Bus 2
- C . Bus 1

### **CONCLUSION**

The MATLAB code for the above problem is run and executed.

### **REFERENCES**

- [1].Stevenson Jr, W. D. (1982). *Elements of Power System Analysis*, (4th), Mc-Graw Hill Higher Education.
- [2].Hadi Saadat, “*Power System Analysis*”, Milwaukee School of Engineering, McGraw Hill, 1999.
- [3].Kothari D. P., Nagrath I. J., “*Modern Power System Analysis*”, Mc-Graw Hill Higher Education.

## APPENDIX

### MATLAB CODE

#### %FAULT AT BUS 3

```
z12=j*.8;z13=j*.4;z23=j*.4;z33=j*.34;zf=j*.16;
V0=[1;1;1];
I3F=V0(1)/(z33+zf)
IG1=0.6/(0.4+0.6)*I3F
IG2=0.4/(0.4+0.6)*I3F
DV1=0-j*0.2*IG1;
DV2=0-j*0.4*IG2;
DV3=j*0.16*I3F-V0(3);
VF1=V0(1)+DV1
VF2=V0(2)+DV2
VF3=V0(3)+DV3
I12=(VF1-VF2)/z12
I13=(VF1-VF3)/z13
I23=(VF2-VF3)/z23
```

#### %FAULT AT BUS 2

```
z12=j*.8;z13=j*.4;z23=j*.4;z22=j*.24;zf=j*.16;
V0=[1;1;1];
I2F=V0(2)/(z22+zf)
IG1=0.4/(0.4+0.6)*I2F
IG2=0.6/(0.4+0.6)*I2F
DV1=0-j*0.2*IG1;
DV2=0-j*0.4*IG2;
DV3=-0.2-((j*0.4)*((-j*1.0)/2))
VF1=V0(1)+DV1
VF2=V0(2)+DV2
VF3=V0(3)+DV3
I12=(VF1-VF2)/z12
I13=(VF1-VF3)/z13
I23=(VF2-VF3)/z23
```

#### %FAULT AT BUS 1

```
z12=j*.8;z13=j*.4;z23=j*.4;z11=j*.14;zf=j*.16;
V0=[1;1;1];
I1F=V0(1)/(z11+zf)
IG1=0.6/(0.4+0.6)*I1F
IG2=0.4/(0.4+0.6)*I1F
DV1=0-j*0.2*IG1;
DV2=0-j*0.4*IG2;
DV3=-0.5+((j*0.4)*((-j*0.625)/2))
VF1=V0(1)+DV1
VF2=V0(2)+DV2
VF3=V0(3)+DV3
I12=(VF1-VF2)/z12
```

$$I_{13}=(VF_1-VF_3)/z_{13}$$

$$I_{23}=(VF_2-VF_3)/z_{23}$$