Washington State University

EE 491 Performance of Power System

Project #2

Power Flow Project

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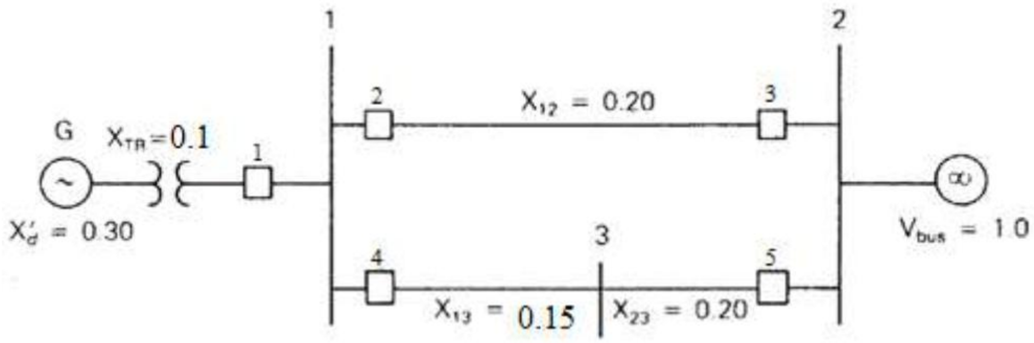
1. Assignment Overview

For the following network write a MATLAB code to do transient stability analysis. The input to your Matlab code should be parameter of the network, fault location. Assume fault is cleared by itself for faults at bus#1 and 2. For fault at bus#3 fault is cleared either by itself or by opening breakers# 4 and#5. Your code should determine the critical clearing time for the fault at buse#1 and #2 and the critical clearing angle for bus#3.



2. Results

1) If a fault occurs at bus#3

a) The critical clearing angle if fault is cleared by itself.

The critical clearing angle if fault is cleared by itself is 2.5223.

```
ans3 =

2.5223145051761027946887647657516
```

b) The critical clearing angle if fault is cleared by opening breakers# 4 and 5

The critical clearing angle if fault is cleared by opening breakers# 4 and 5 is 2.4758.

```
ans4 =

2.4767796768148180213169741374679
```

2) If a fault occurs at bus#1 or bus#2

a) The critical clearing time if fault is cleared by itself.

According the results matlab, we can know the critical clearing time if fault at bus# 1 or bus#2 is cleared by itself.

```
t1 =

0.20771024544733235681988386870037
```

We can know the critical clearing time is 0.2077s .

b) Determine whether the system stays stable if the fault is cleared after 12 cycles by itself

```
cycle1 =

12.462614726839941409193032122022
```

We can get the 12 < cycle1. Therefore, the system is stable.

3. Code

```
clear all;

clc

format short;



syms del x del1 e1
```

```
%% The fault at bus 1 or bus 2

Xeq= (0.4+ (0.2*(0.35) / (0.35+0.2)))*i;

pf=0.95;

V0=1*exp(0*i);

theta1= -acos(pf);

I_magnitude=1/pf;



I= I_magnitude*exp(i*theta1);

V1=V0+I*Xeq;

Pe1 = (abs(V1)*V0/abs(Xeq))*sin(del);
Pe1_magnitude=(abs(V1)*V0/abs(Xeq));
del0= asin(1/abs(Pe1_magnitude));

%%% Pre-fault
```

```
Pe1=Pe1_magnitude

%%% During-fault

Pe2=0

%%% Post-fault

Pe3=Pe1_magnitude

%%%
A1=int(1,del0,x);
A2=int(Pe1-1,x,pi-del0);
Area=A1-A2;
Y=Area==0;

ans1 = vpa(solve(Y));
rad=ans1;
ang=ans1(1)*180*(1/pi);

H=3;
```

```
%%% critical clearing time
t1=vpa(sqrt(4*H*(rad-del0)/(2*pi*60)));

cycle1=t1*60;

%% Fault at bus 3

%%% pre-fault

Pe3_1=Pe1_magnitude;

%%% During-fault
y2=(e1-1)/0.2+e1/0.15;
Y2=y2==0;
ans2=vpa(solve(Y2));
e2=ans2;

Xeq2=(0.2*0.15)/(0.2+0.15)+0.4;
Pe3_2=(abs(V1)*e2)/Xeq2;
```

```
% del00= 61.77*pi/180;

%%%% Post-Fault   clear by itself

Pe3_3= Pe1_magnitude;

A1=int(1-Pe3_2,del0,x);
A2=int(Pe3_3-1,x,pi-del0);
Area2=abs(A1)-abs(A2)==0;

%

ans3=vpa(solve(Area2));
ans3=ans3(1);


% A2_1=int(1-Pe3_2,del0,x);
% A2_2=int(Pe3_3-1,x,pi-del0);
% Area2=A2_1-A2_2;
% Y3=Area2==0;
%
```

```
% ans3=vpa(solve(Y3));



%%%% Post-Fault  clear by breakers 4 & 5


Xeq3=0.6;

Pe3_4=abs(V1)/Xeq3;


A3_1=int(1-Pe3_2,del0,x);

A3_2=int(Pe3_4-1,x,pi-del0);

Area3=abs(A3_1)-abs(A3_2);

%

ans4=vpa(solve(Area3));

ans4=ans4(1);
```