Simulation Results of Fault Type Classifier

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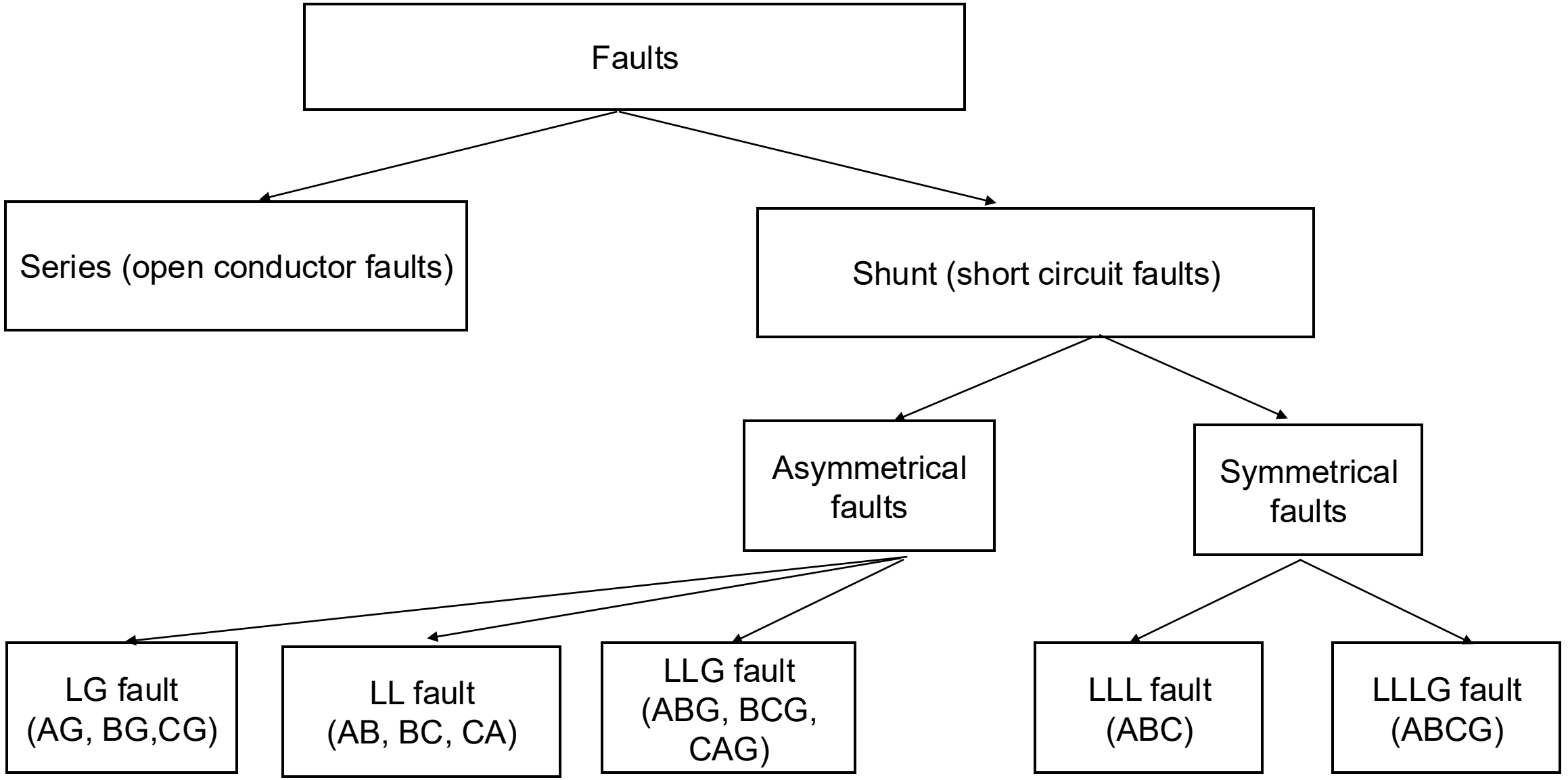
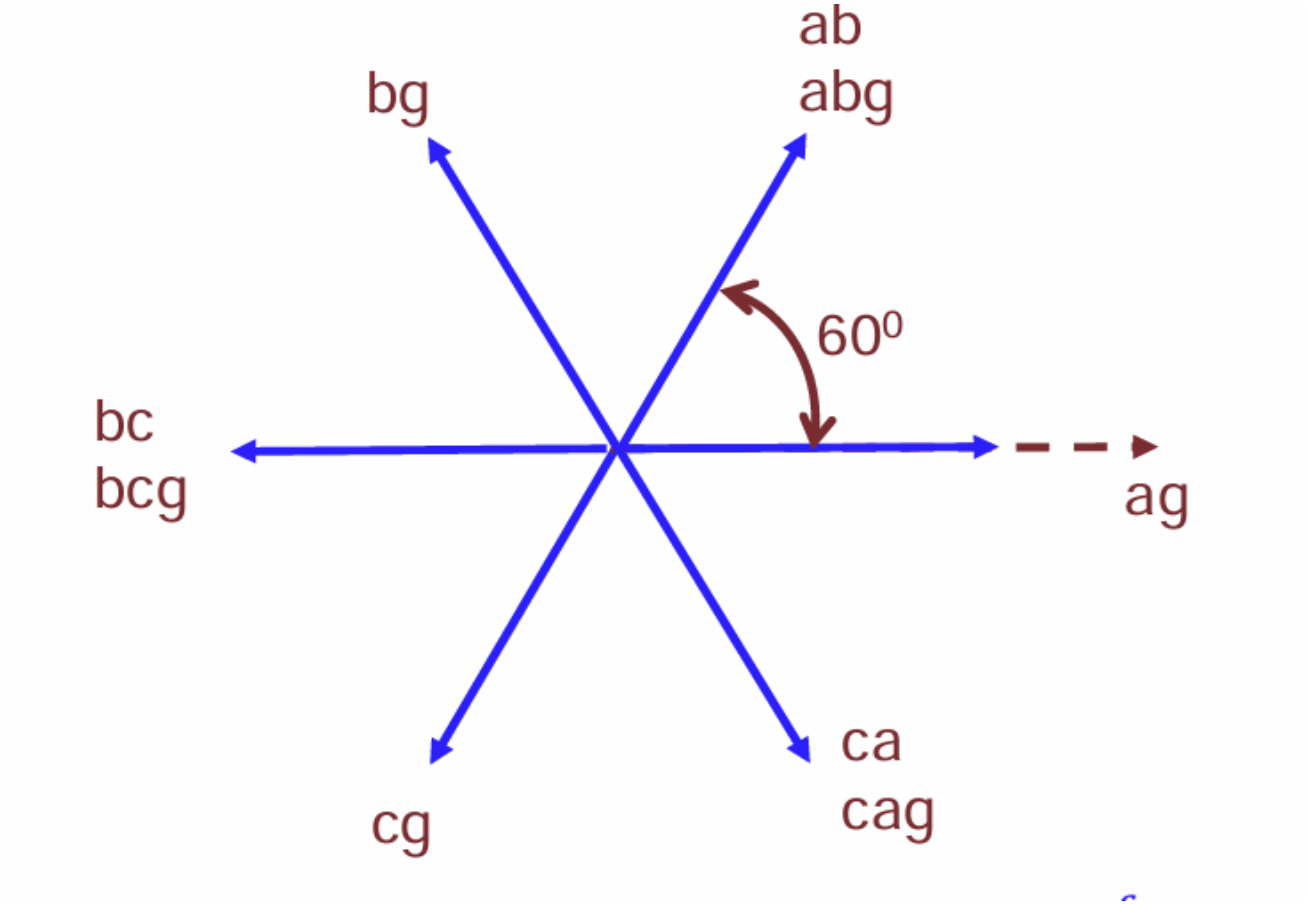
Recap.....

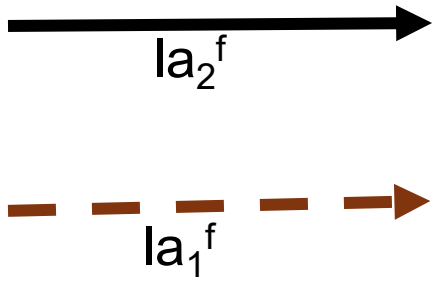
Types of Faults in transmission lines



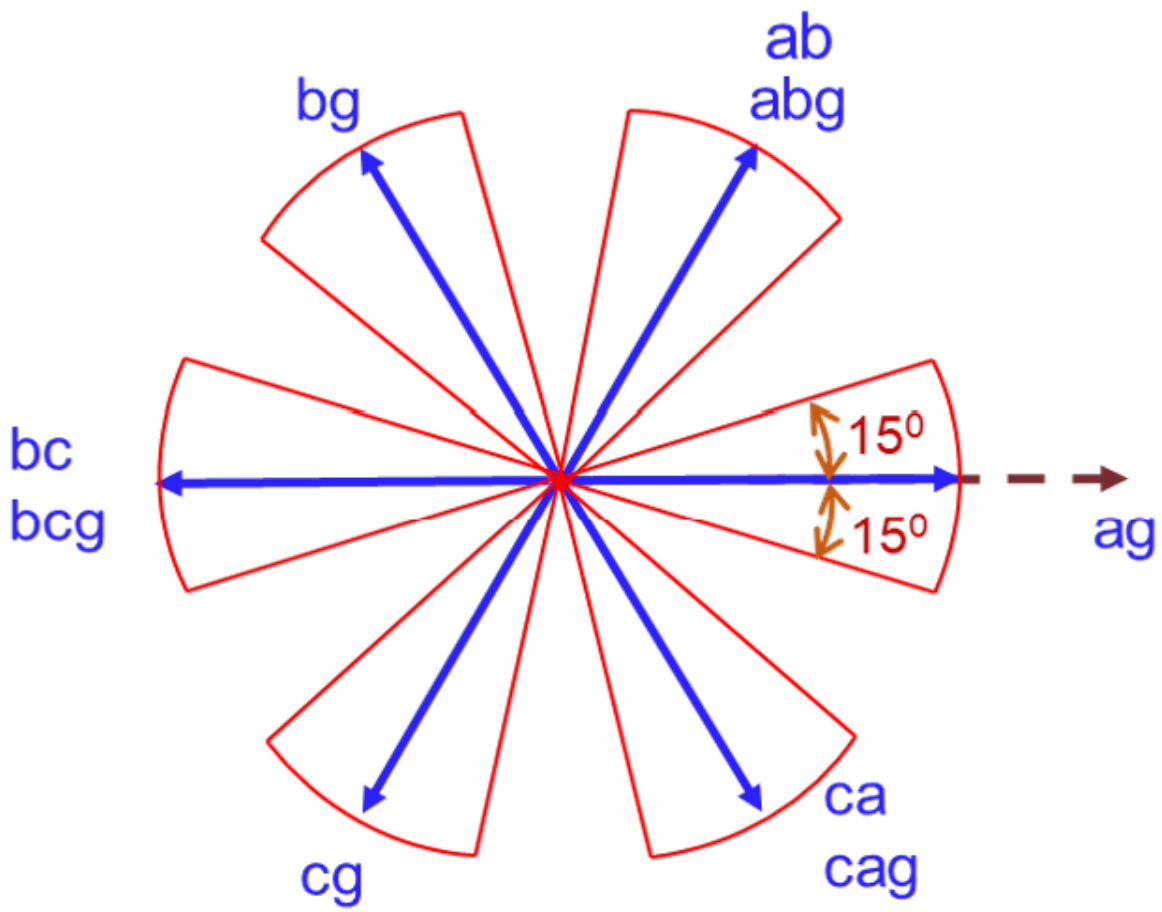
Fault Classification Logic- Sequence Current Based

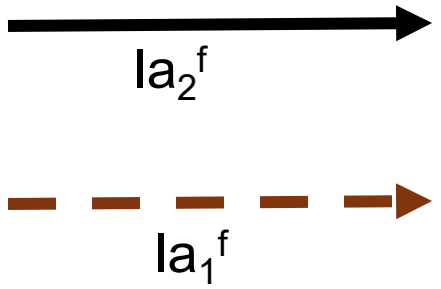


Phasor Positions of Ia_2^f with respect to Ia_1^f



Fault Classification Logic

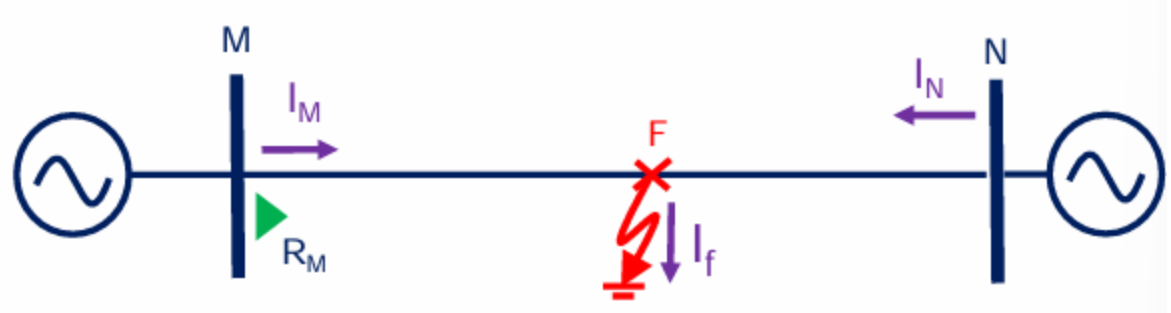




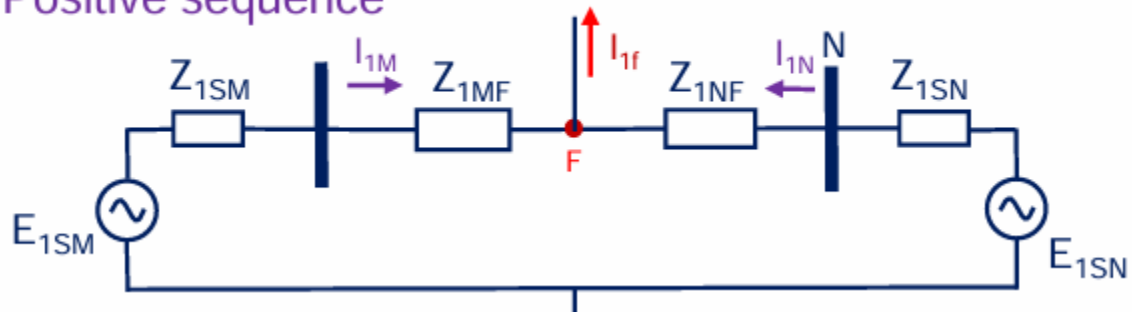
Margin =±15°

Sequence Current Based Method

R_M measures I_M , not I_f



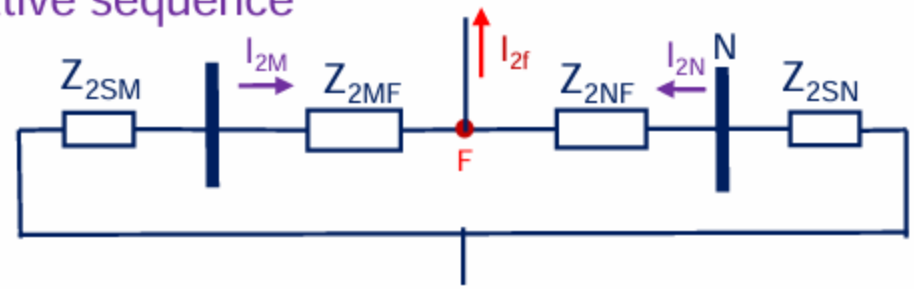
Positive sequence



How to get $\angle I_{1f}$ = ??

All impedance angles be same- source to line (homogeneous)

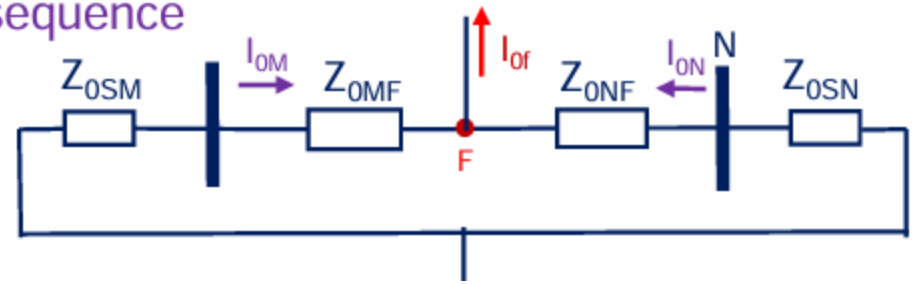
Negative sequence



$$I_{2f} = \frac{I_{2M}\,(Z_{2SM} + Z_{2MF} + Z_{2NF} + Z_{2SN})}{Z_{2NF} + Z_{2SN}}$$

$\angle I_{2f} = \angle I_{2M}$

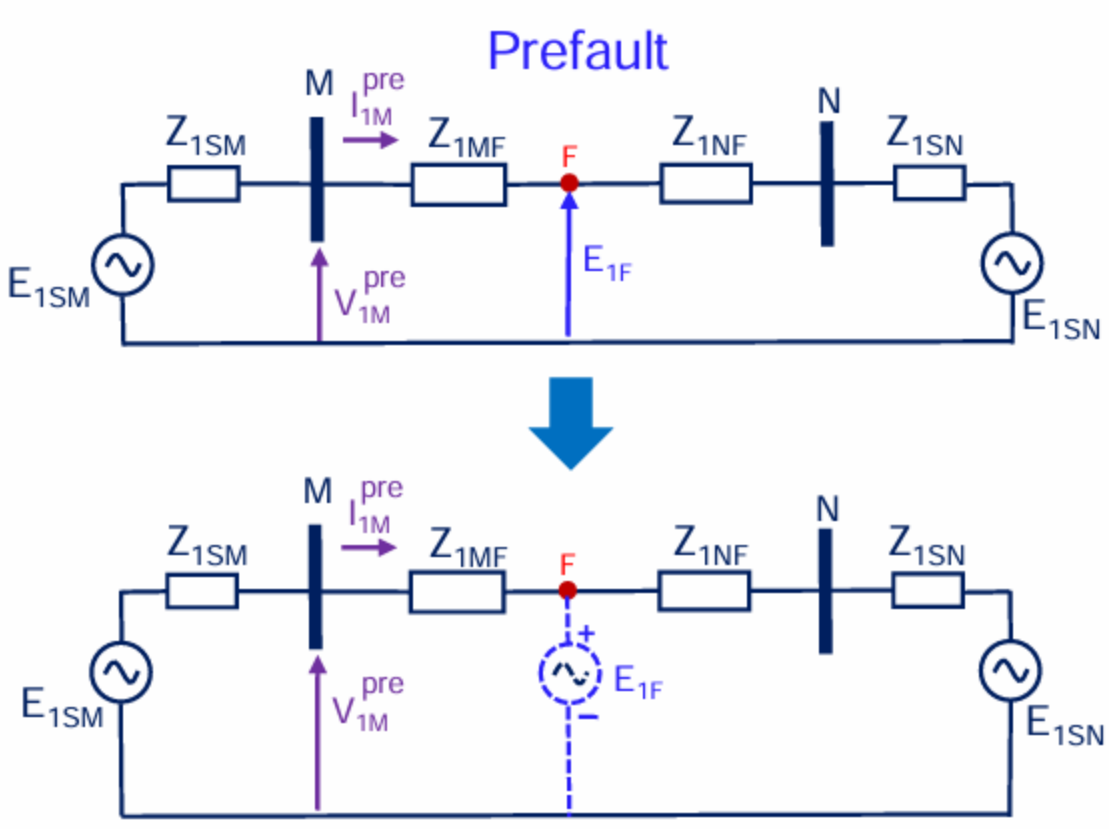
Zero sequence

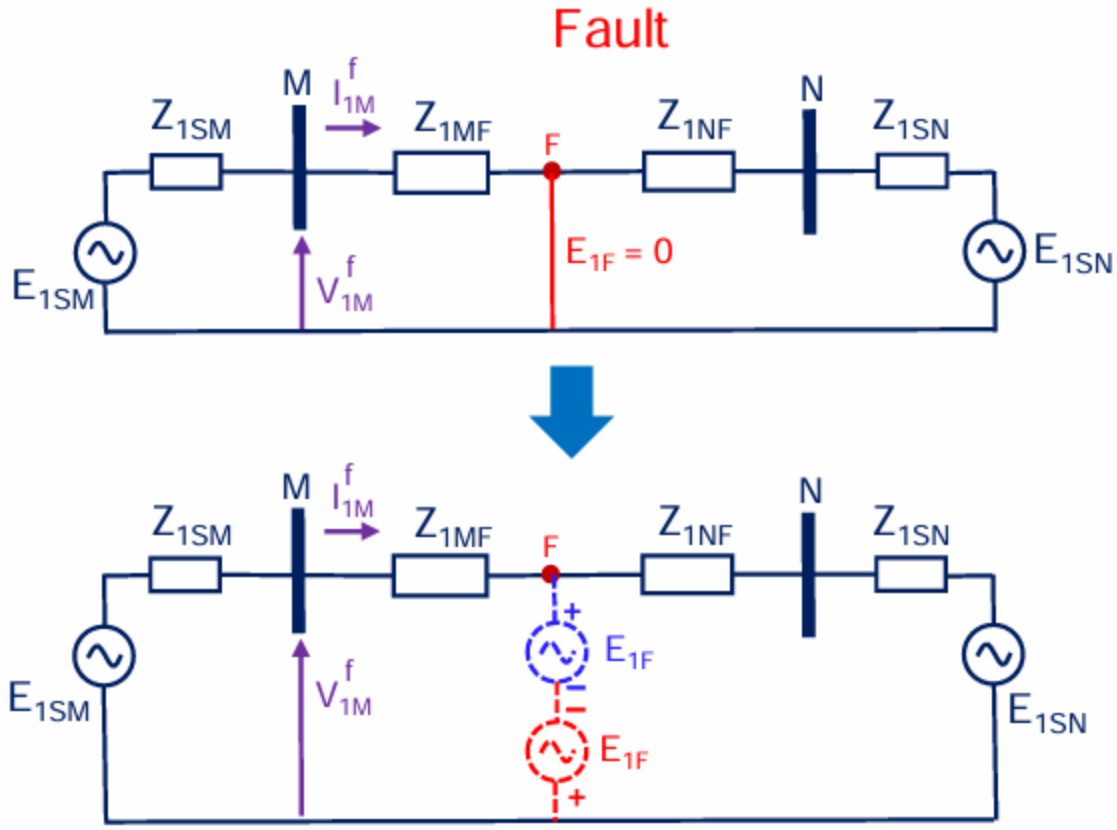


$$I_{0f} = \frac{I_{0M}\,(Z_{0SM} + Z_{0MF} + Z_{0NF} + Z_{0SN})}{Z_{0NF} + Z_{0SN}}$$

$\angle I_{0f} = \angle I_{0M}$

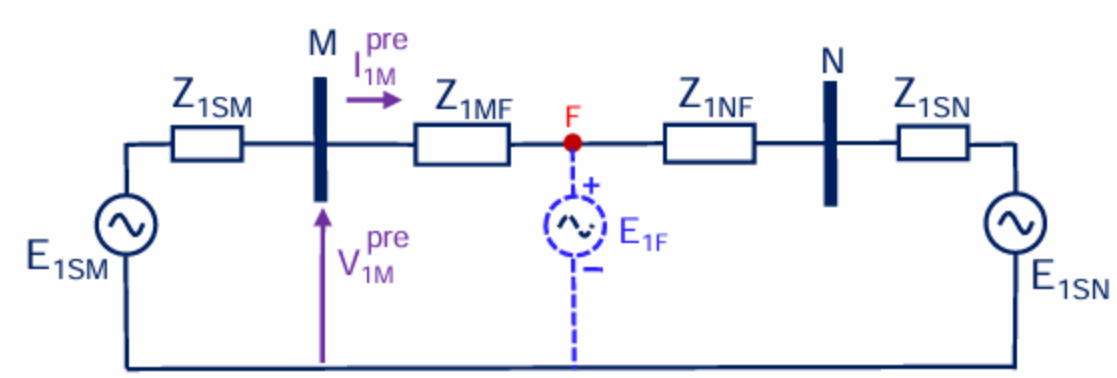
How to get the positive sequence fault components of currents ?



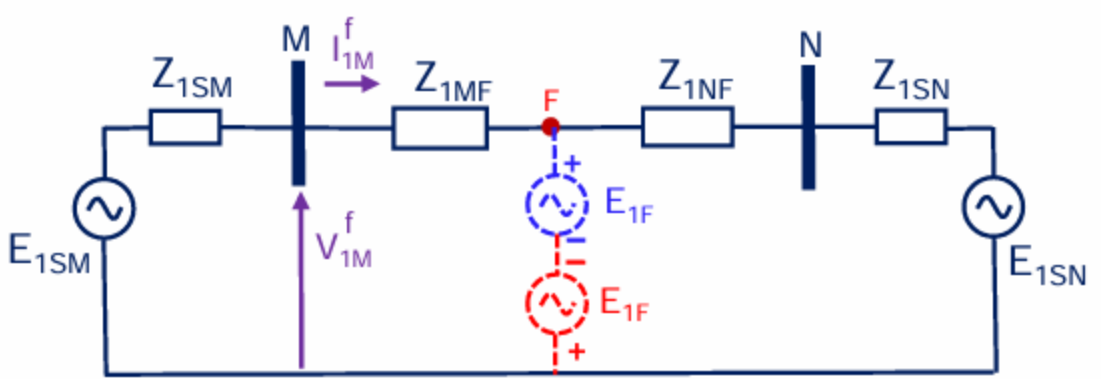


I_f=0 , Only Prefault Current

Positive Sequence Diagrams



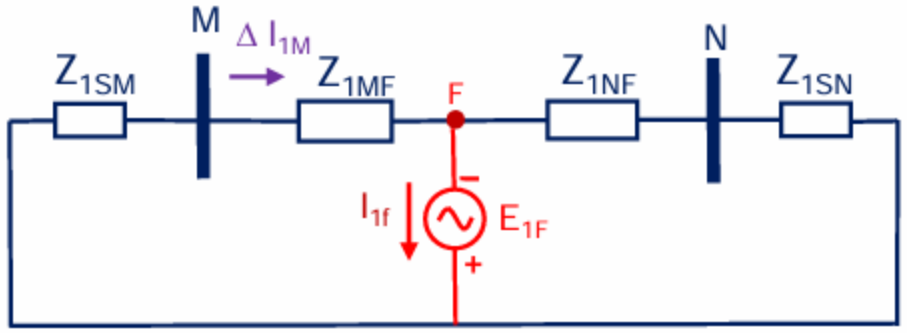
I_f=0 , Only Prefault Current



Fault

Pure-Fault Component = Fault Component – Prefault Component

- Superimposition

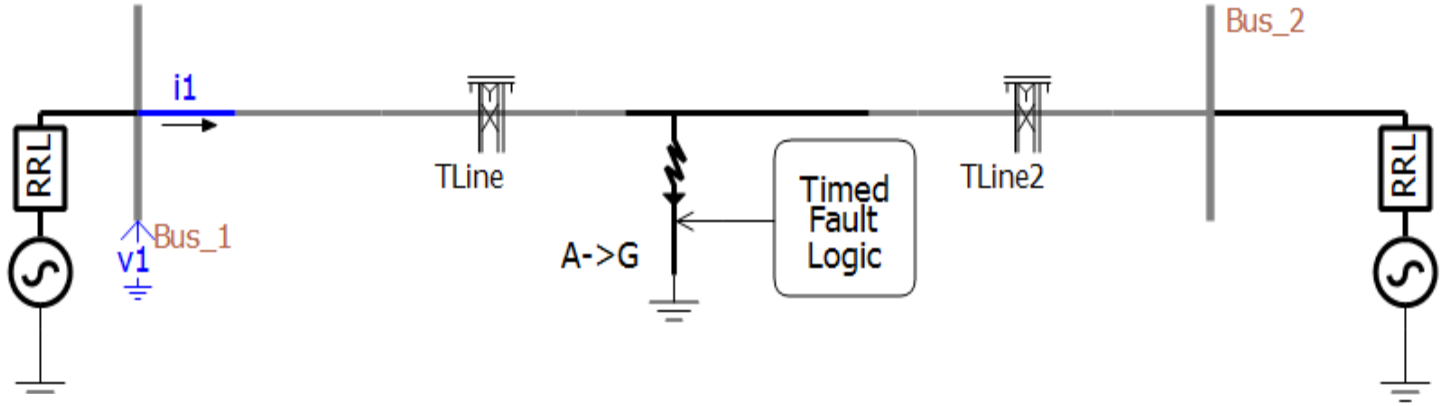


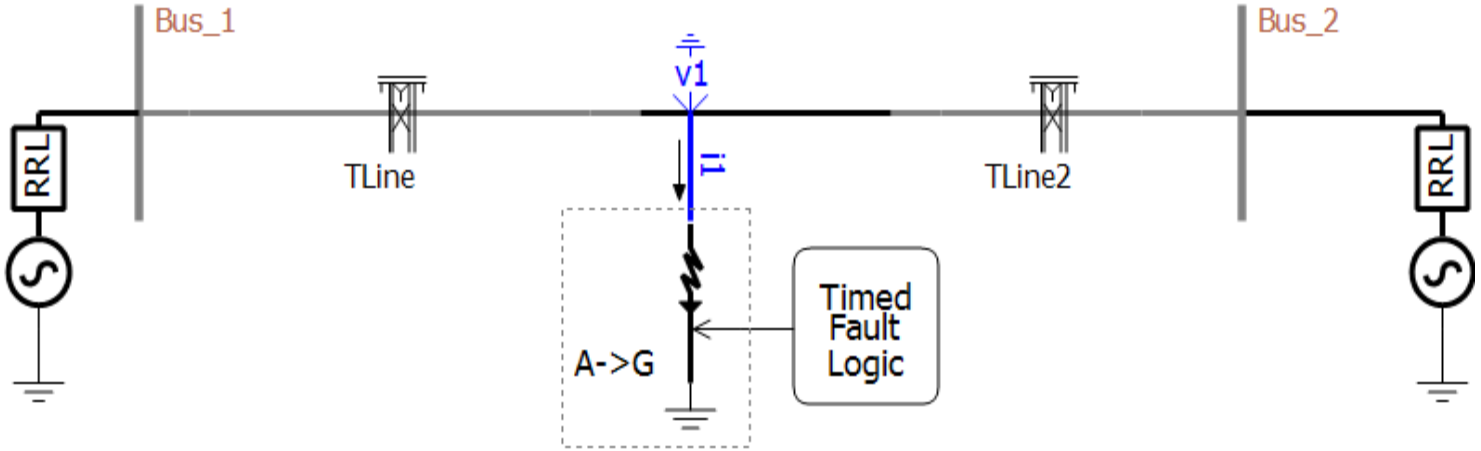
$$I_{1f} = \frac{\Delta I_{1M}\,(Z_{1SM} + Z_{1MF} + Z_{1NF} + Z_{1SN})}{Z_{1NF} + Z_{1SN}}$$

$\angle I_{1f} = \angle \Delta I_{1M}$

$\Delta I_{1M} = I^{f}_{1M} - I^{pre}_{1M}$

Case 1



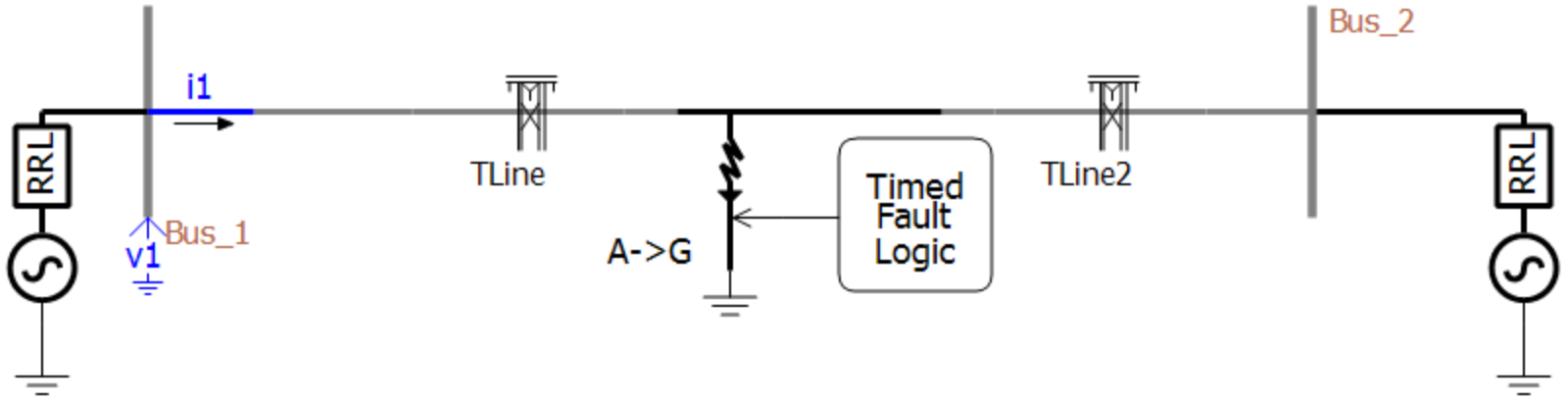


Case 2

Fault Pre-Fault

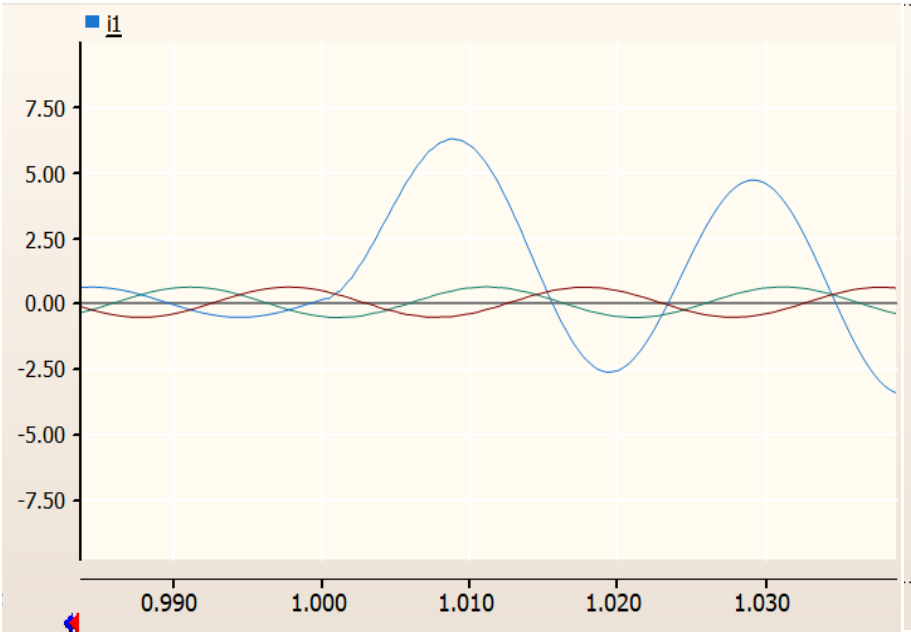
```
delta_i1m = angle(Ia1(6000)-Ia1(2000))*180/pi
i2m= angle(Ia2(6000))*180/pi
c = i2m-delta_i1m
i0m = angle(Ia0(6000))*180/pi
e = i2m -i0m
```

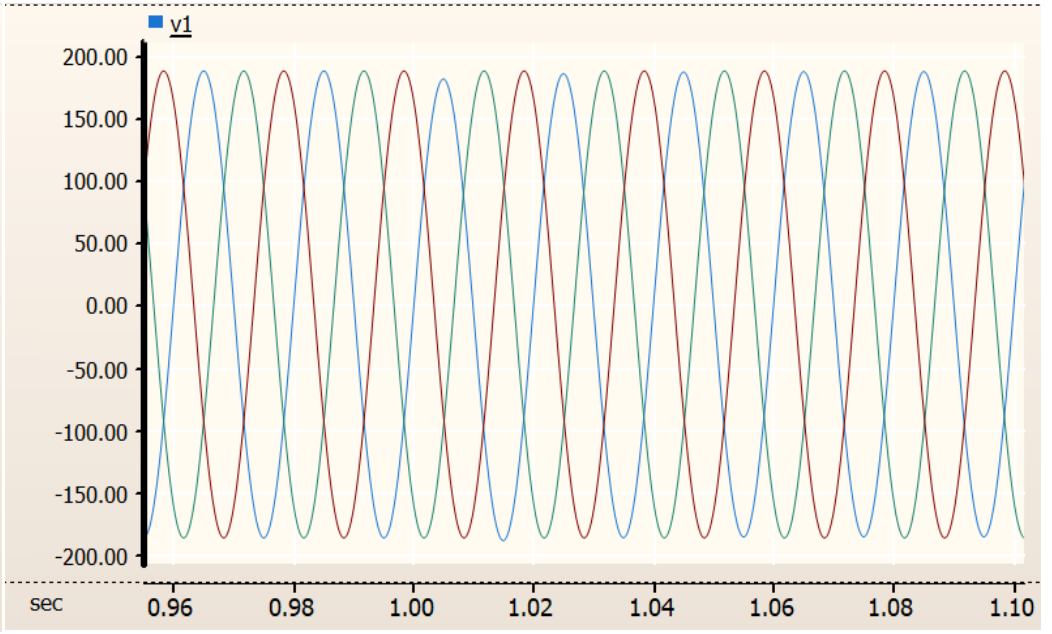
AG Fault(R_f =1ohm)



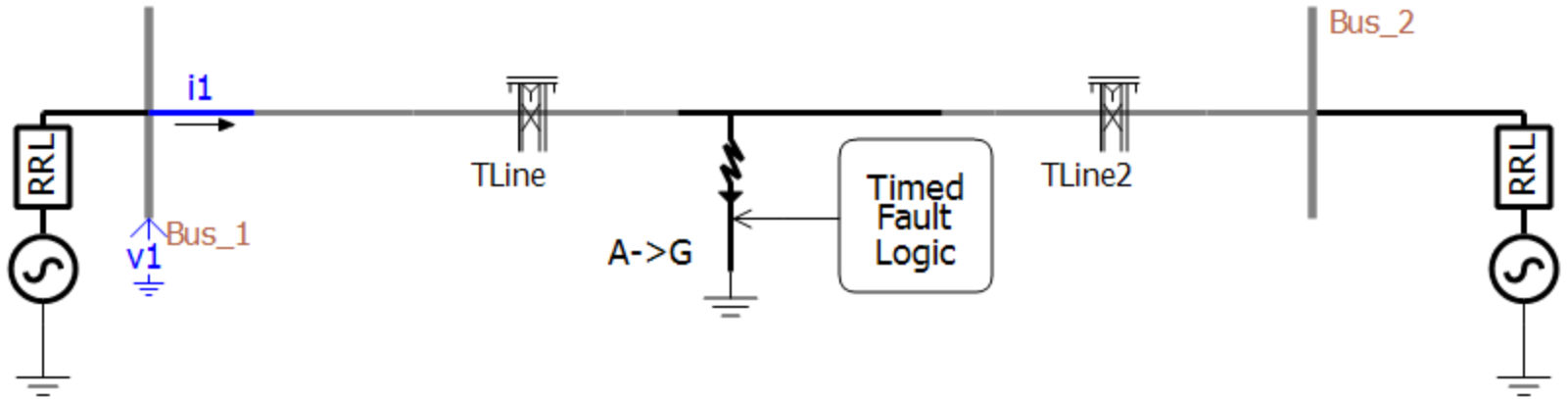
Name for Identification	
Time to Apply Fault	1.0 [s]
Duration of Fault	2.0 [s]

```
delta_i1m = -174.3910

i2m = -174.3912

c = -1.6789e-04

i0m = -174.4291

e = 0.0379
```



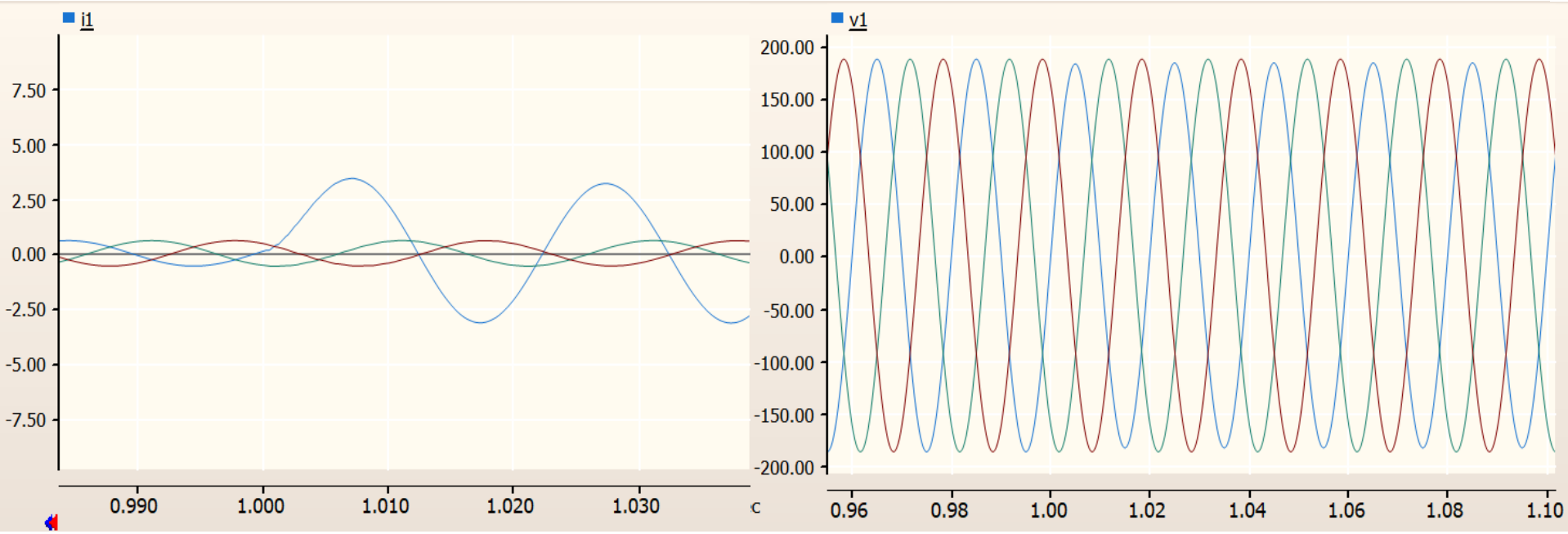


AG Fault(R_f =20 ohm)

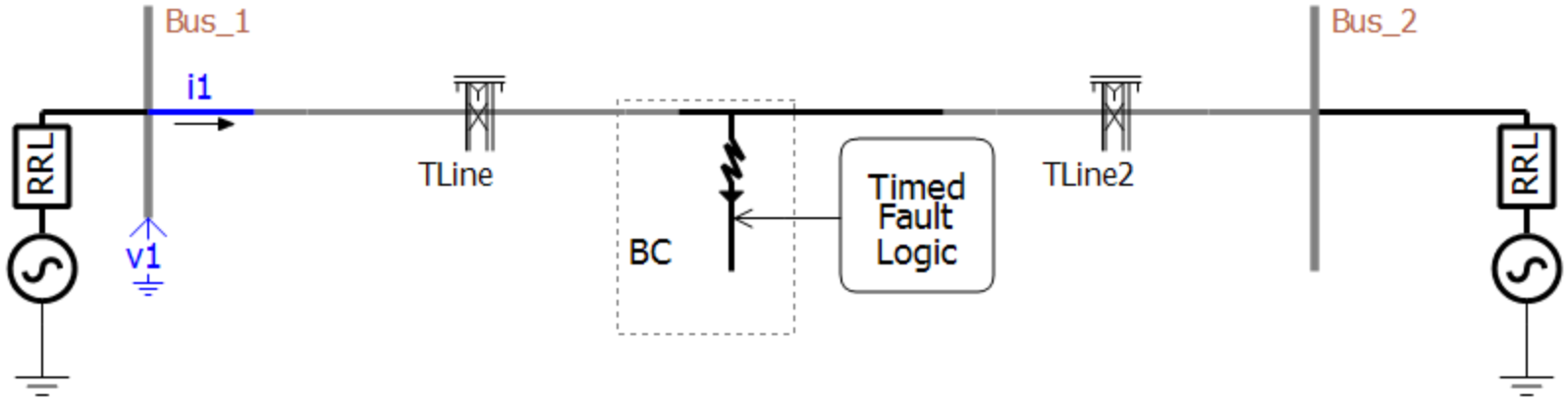


Name for Identification	
Time to Apply Fault	1.0 [s]
Duration of Fault	2.0 [s]

```
delta_i1m = -140.3286

i2m = -140.3289

c = -2.9197e-04

i0m = -140.3668

e = 0.0379
```

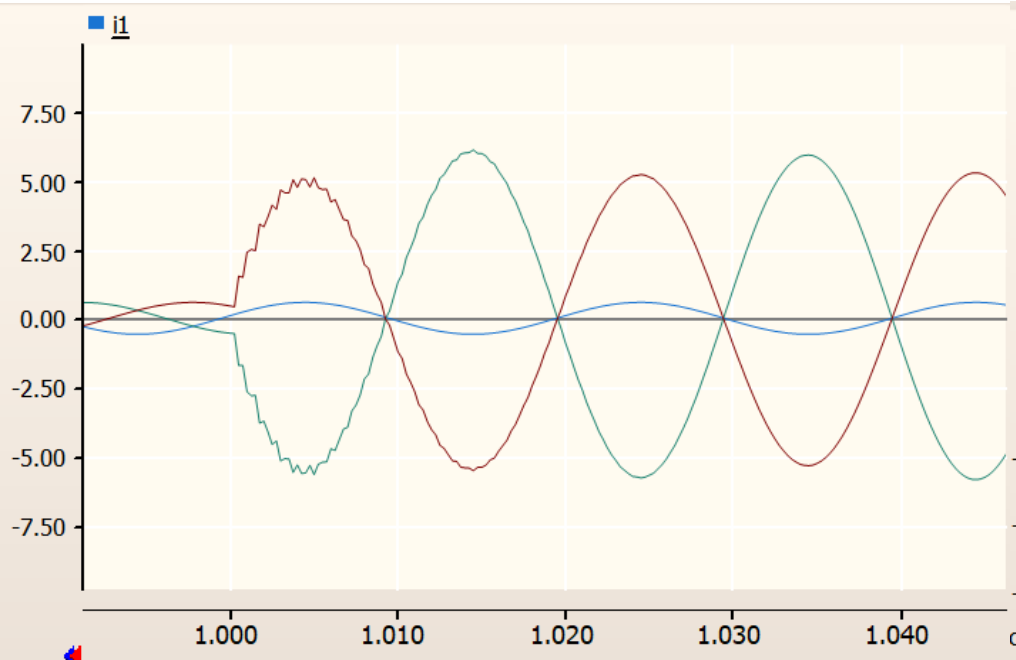


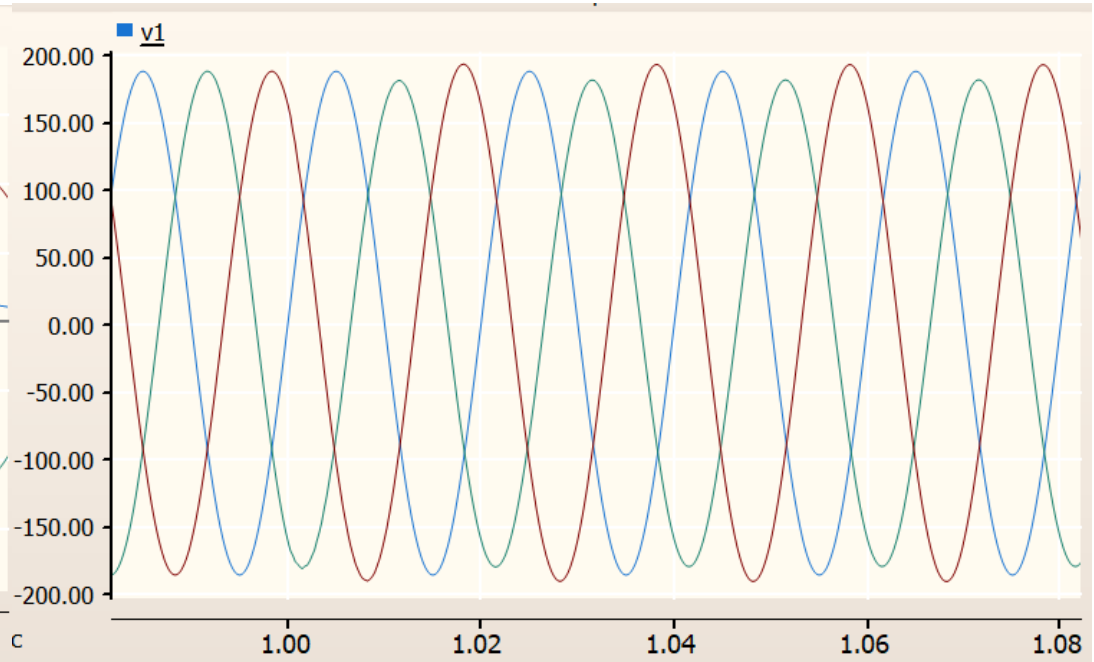
BC Fault(R_f =1ohm)



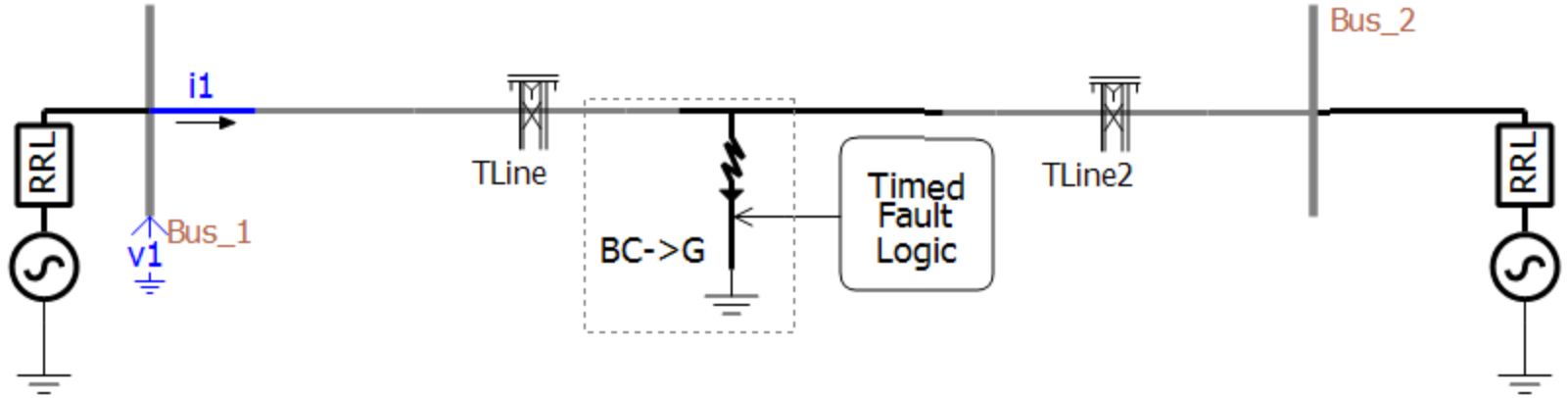
Name for Identification	
Time to Apply Fault	1.0 [s]
Duration of Fault	2.0 [s]

```
delta_i1m = -175.1997

i2m = 4.8002

c = 179.9999
```



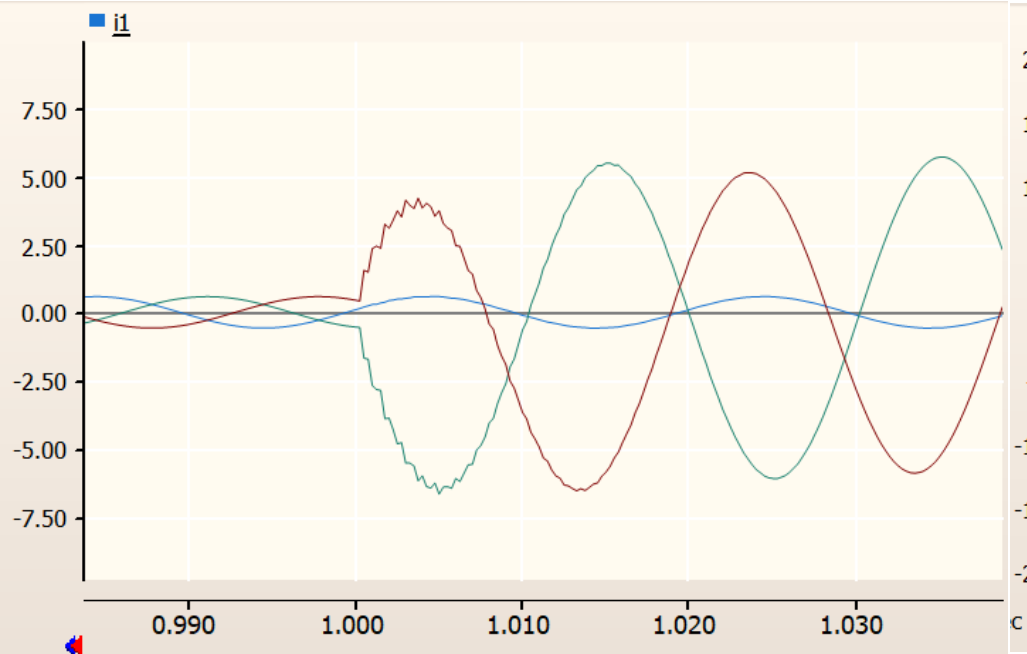


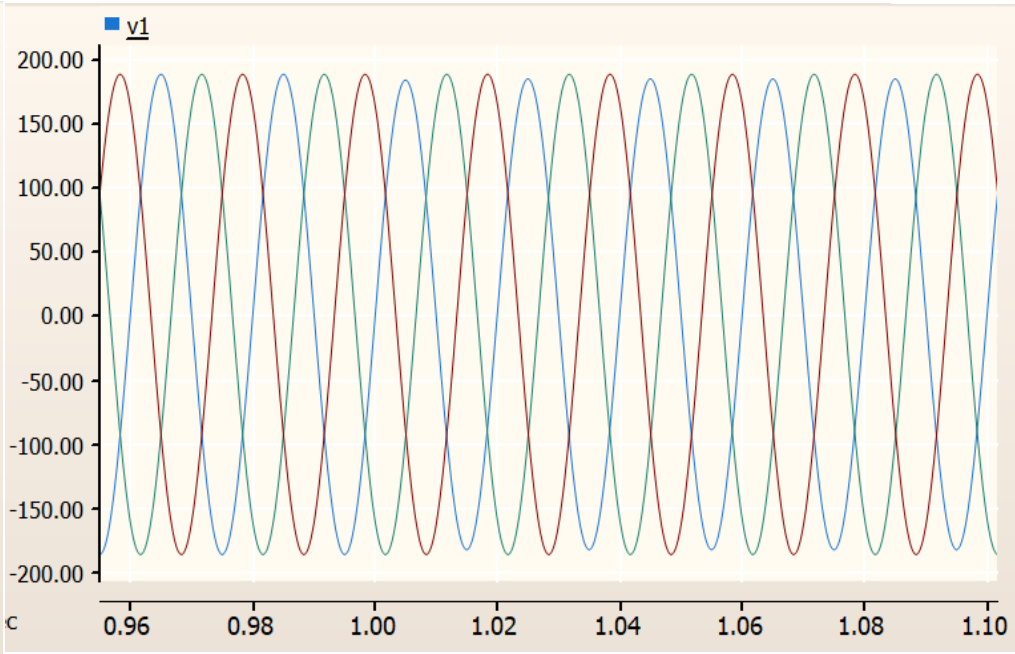
BCG Fault(R_f =1ohm)



Name for Identification	
Time to Apply Fault	1.0 [s]
Duration of Fault	2.0 [s]

```
delta_i1m = -173.4860

i2m = 6.9932

c = 180.4792

i0m = 5.0820

e = 1.9112
```

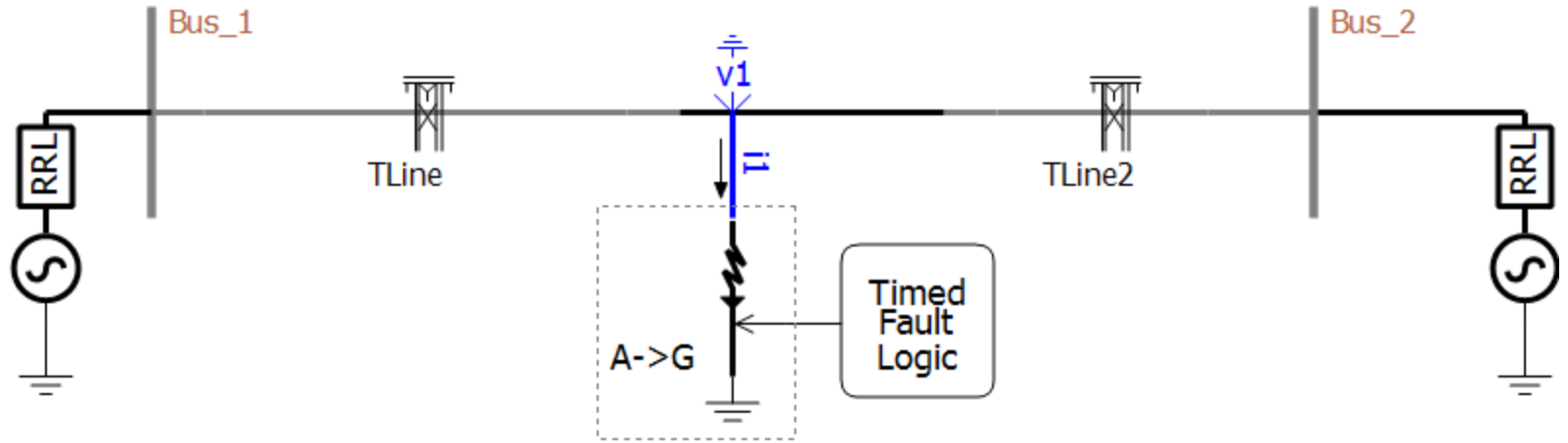




1.Ammeter connected to M Bus

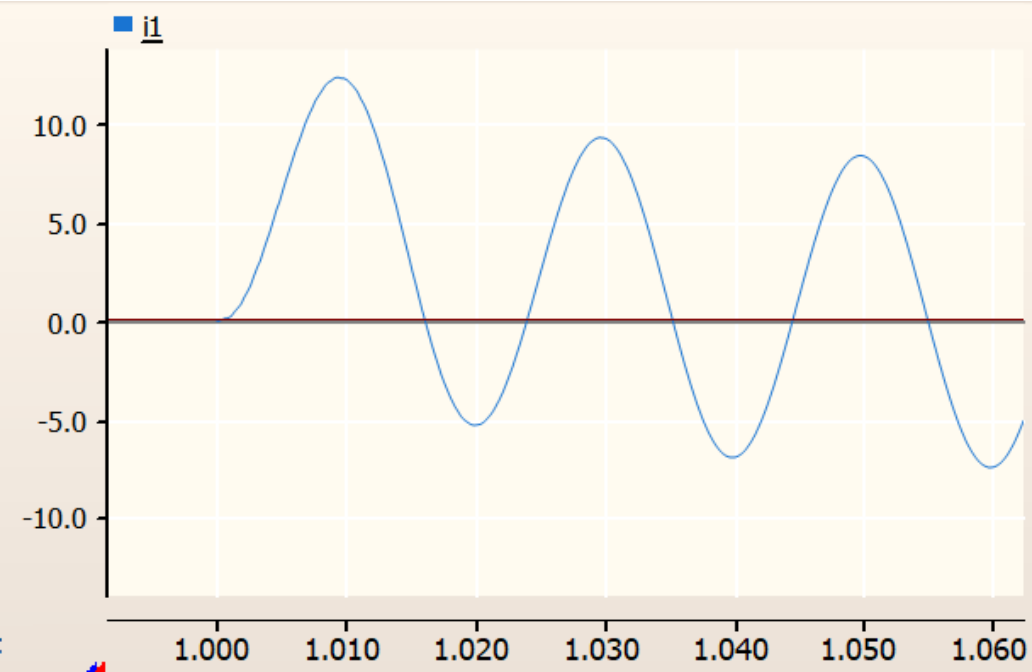
Fault Type	R_f(ohm)	$\angle \Delta I_1M$	$\angle I_2M$	$\angle I_0M$	$\angle I_2M - \angle \Delta I_1M$	$\angle I_2M - \angle I_0M$
AG	1	-174.3910	-174.3912	-174.4291	-1.6789e-04	0.0379
	20	-140.3286	-140.3289	-140.3668	-2.9197e-04	0.0379
BG	1	-174.3913	-54.3914	65.5706	119.9998	-119.9621
	20	-140.3286	-20.3289	99.6332	119.99897	-119.9621
CG	1	-174.3920	65.6078	-54.4301	-120.0002	120.0379
	20	-140.3286	99.6711	-20.3668	-120.0003	120.0379
ABG	1	-173.4848	-113.0048	125.0812	60.4799	121.9139
	20	-131.7176	-63.2118	152.0087	68.5058	144.7795
BCG	1	-173.4860	6.9932	5.0820	180.4792	1.9112
	20	-131.7176	56.7882	32.0088	-171.4942	24.7794
CAG	1	-173.4857	126.9938	-114.9182	-59.5205	-118.088
	20	-131.7176	176.7882	-87.9913	-51.4942	-95.2205
AB	1	-175.1971	-115.1971		59.9999	
	20	-145.2751	-85.2752		59.9999	
BC	1	-175.1997	4.8002		179.9999	
	20	-145.2751	34.7247		179.9999	
CA	1	-175.1990	124.8009		-60.0001	
	20	-145.2751	154.7248		-60.0001	

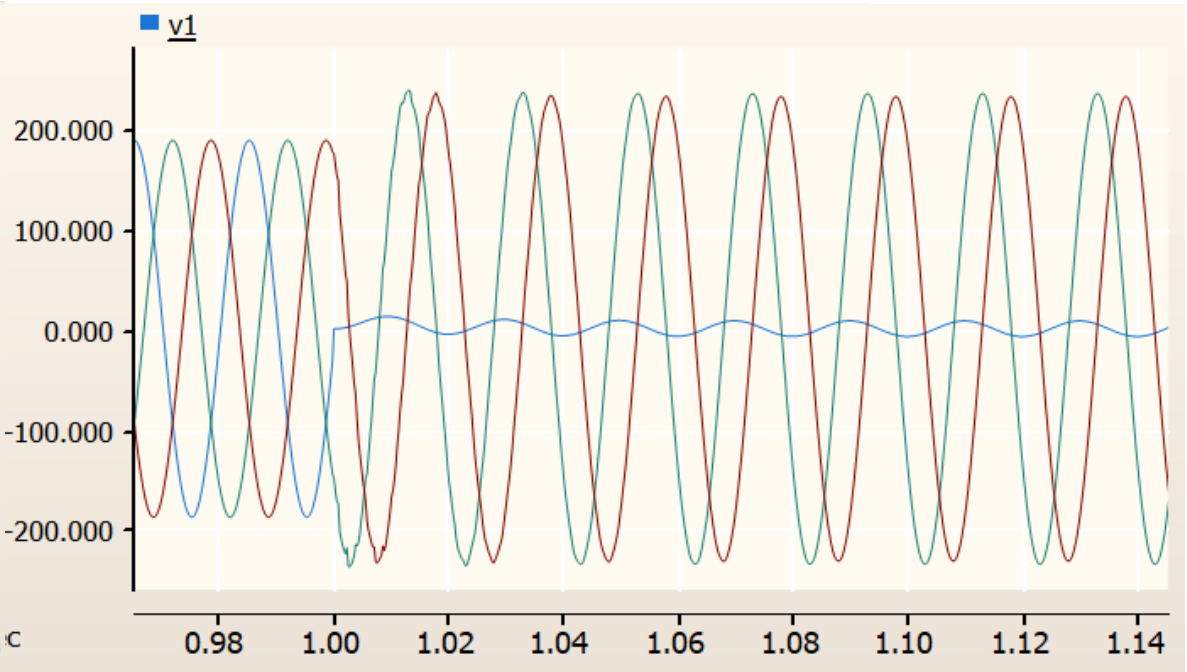
AG Fault(R_f =1 ohm)



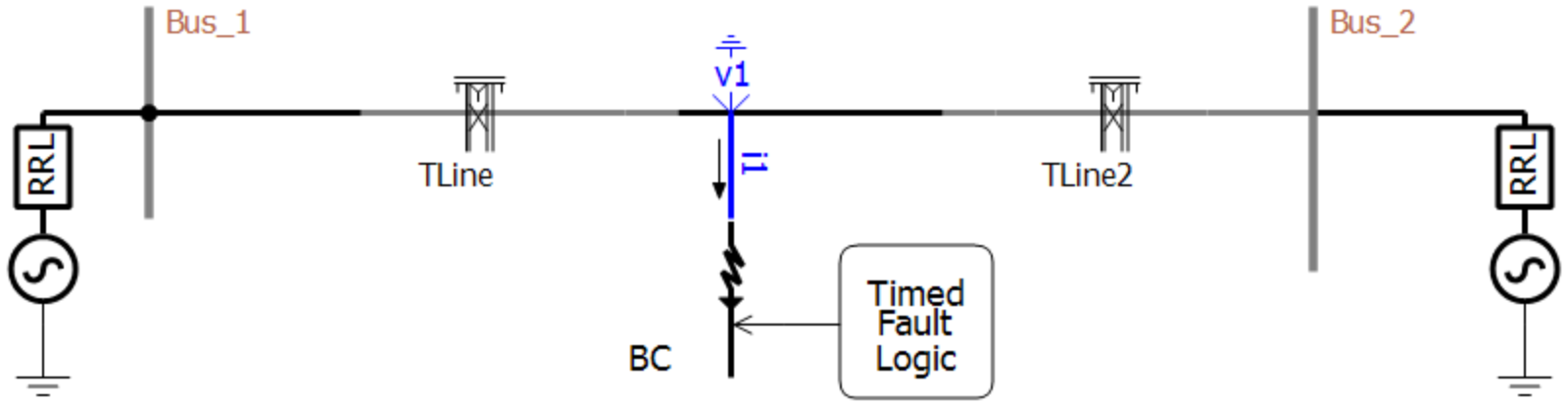
Name for Identification	
Time to Apply Fault	1.0 [s]
Duration of Fault	2.0 [s]

```
delta_i1m = -174.3279

i2m = -174.3279

c = 2.0748e-12

i0m = -174.3271

e = -8.8556e-04
```



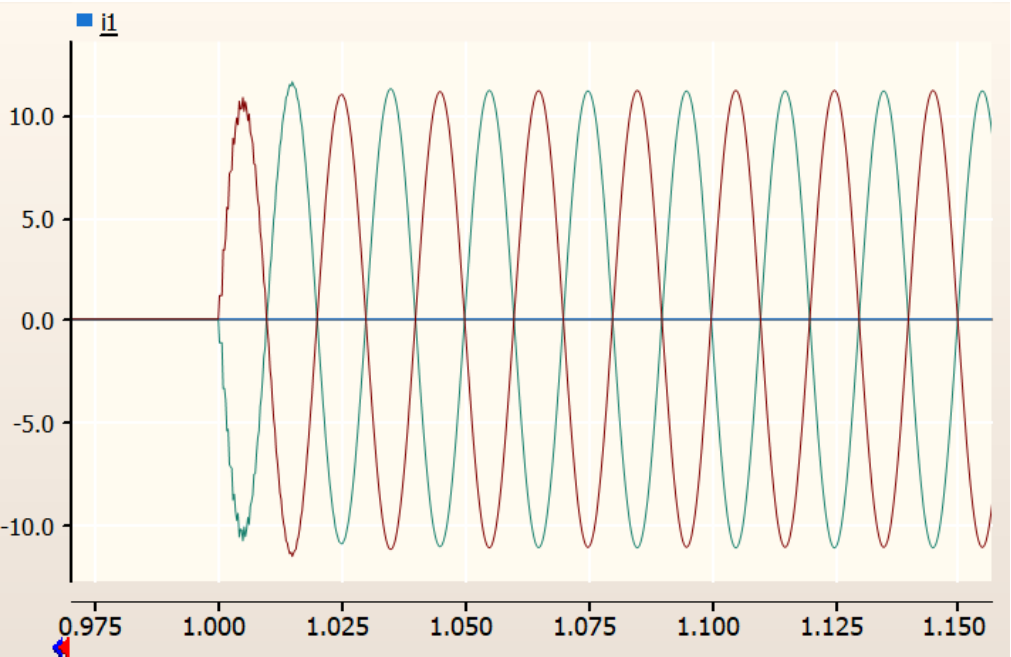


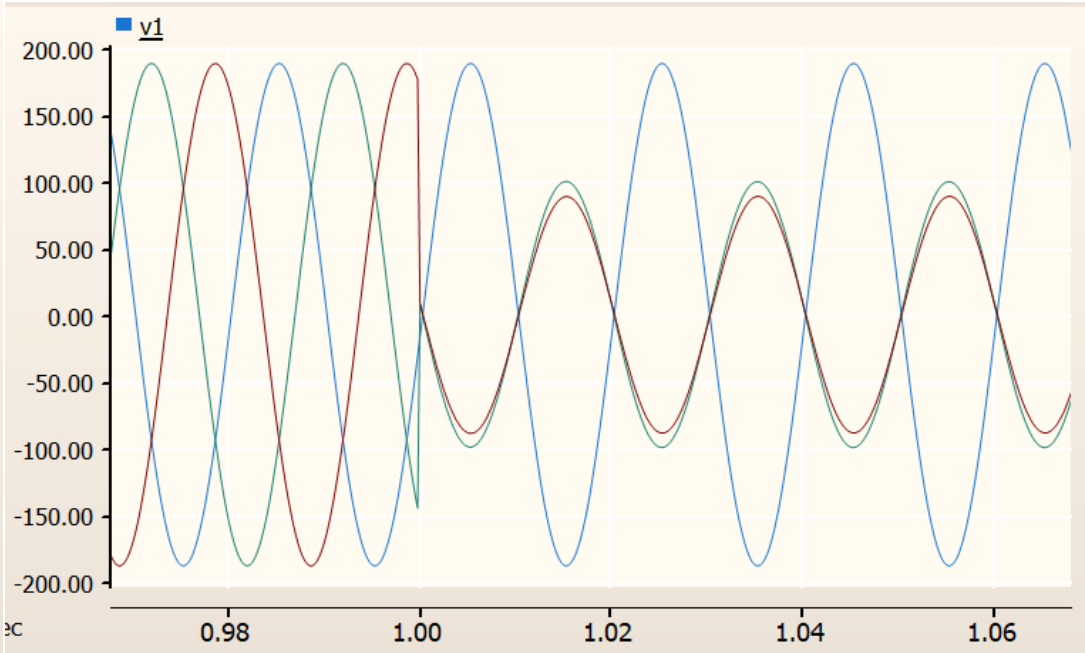
BC Fault(R_f =1 ohm)



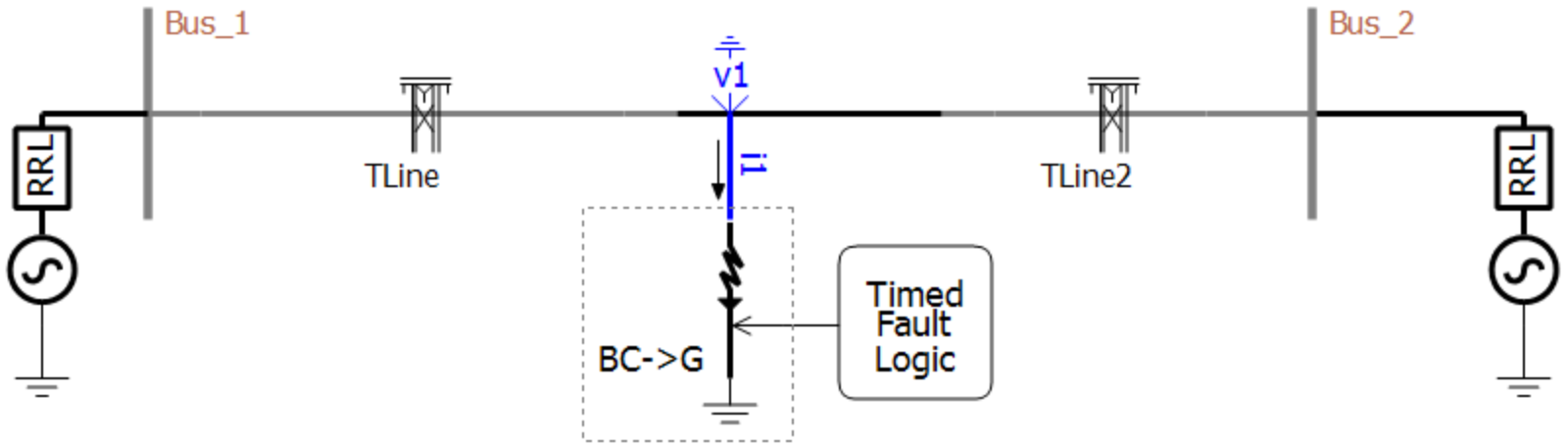
Name for Identification	
Time to Apply Fault	1.0 [s]
Duration of Fault	2.0 [s]

```
delta_i1m = -175.1366

i2m = 4.8634

c = 180.0000
```



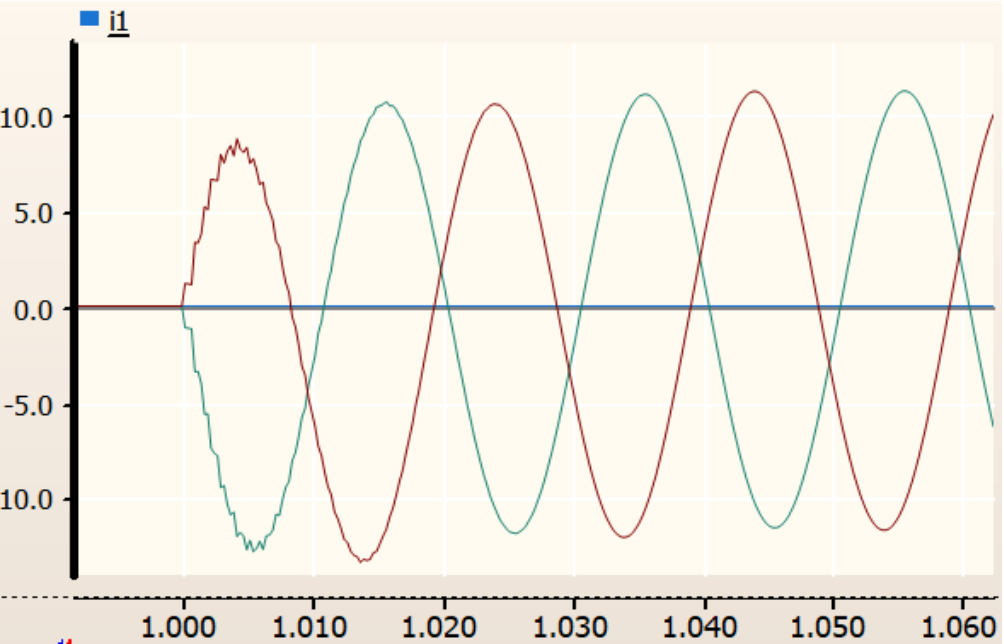


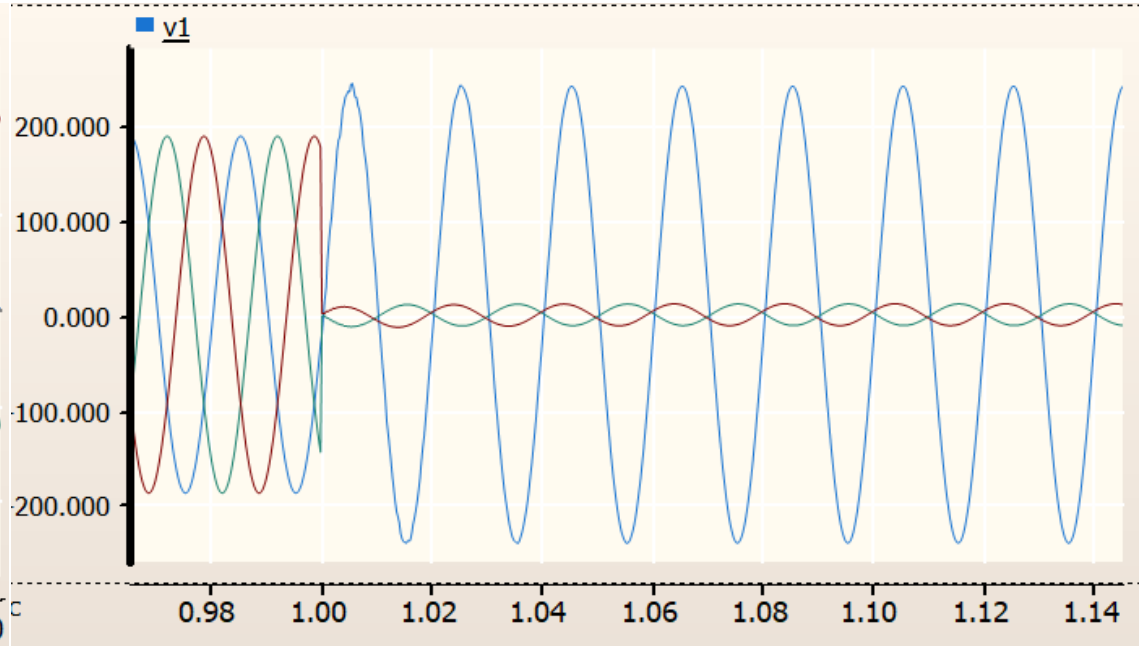
BCG Fault(R_f =1 ohm)



Name for Identification	
Time to Apply Fault	1.0 [s]
Duration of Fault	2.0 [s]

```
delta_i1m = -173.4229

i2m = 7.0564

c = 180.4793

i0m = 5.1840

e = 1.8724
```





2.Ammeter connected to Faulted Path

Fault Type	R_f(ohm)	$\angle \Delta I_1M$	$\angle I_2M$	$\angle I_0M$	$\angle I_2M - \angle \Delta I_1M$	$\angle I_2M - \angle I_0M$
AG	1	-174.3279	-174.3279	-174.3271	2.0748e-12	-8.8556e-04
	20	-140.2656	-140.2656	-140.2647	1.0004e-11	-8.8556e-04
BG	1	-174.3282	-54.3282	65.6727	120.0000	-120.0009
	20	-140.2657	-20.2657	99.7352	120.0000	-120.0009
CG	1	-174.3290	65.6710.	-54.3281	-120.0000	119.9991
	20	-140.2657	99.7343	-20.2648	-120.0000	119.9991
ABG	1	-173.4216	-112.9416	125.1833	60.4800	121.8751
	20	-131.6545	-63.1486	152.1108	68.5059	152.1108
BCG	1	-173.4229	7.0564	5.1840	180.4793	1.8724
	20	-131.6545	-56.8514	36.0691	-171.4941	24.7406
CAG	1	-173.4225	127.0570	-114.8162	-59.5205	-118.1268
	20	-131.6545	176.8515	-87.8892	-51.4941	-95.2593
AB	1	-175.1339	-115.1339		60.0000	
	20	-145.2120	-85.2120		60.0000	
BC	1	-175.1366	4.8634		180.0000	
	20	-145.2120	34.7880		180.0000	
CA	1	-175.1359	124.8641		-60.0000	
	20	-145.2120	154.7880		-60.0000	

Thank You !