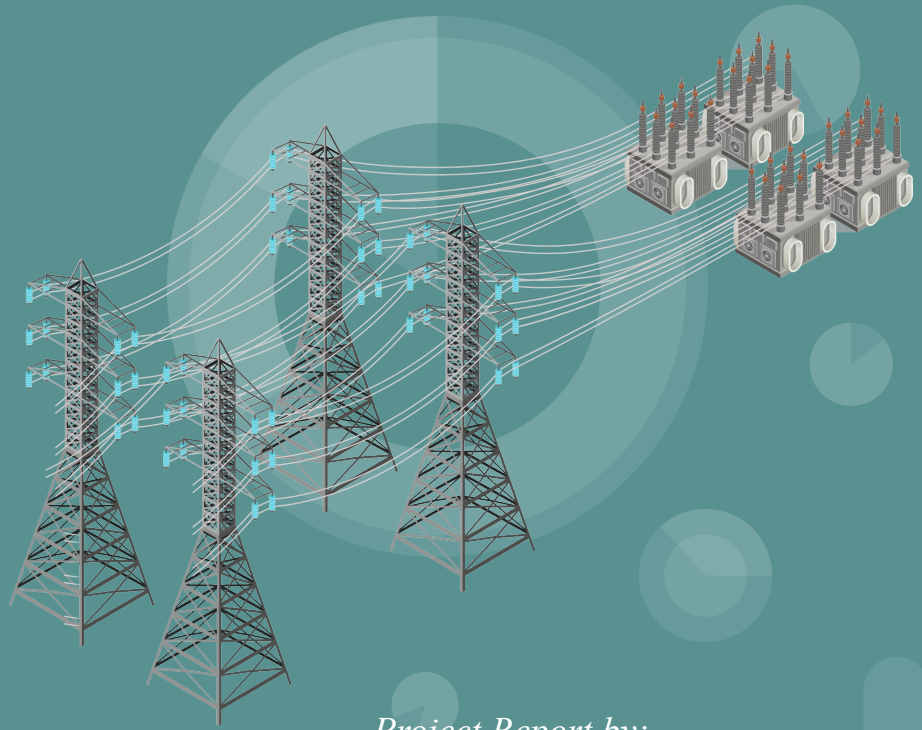
EE-308
Power Systems



Behaviour of a Power System during transient events

Project Report by:

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Introduction

Power system dynamics is the study of how a power system responds to changes in its operating conditions. Transient events refer to disturbances that occur in the power system, such as faults, switching operations, and sudden changes in load or generation. During such events, the system experiences rapid changes in voltage, current, and frequency, which can affect the stability and reliability of the power system.

One of the main goals of power system dynamics is to ensure that the power system remains stable during transient events. Stability refers to the ability of the power system to maintain a steady state of operation despite disturbances. This is achieved by controlling the power system through various means, such as adjusting the output of generators, using protective devices, and coordinating the operation of different components.

Overview of the project

As mentioned in the introduction, Transient events refer to disturbances that occur in the power system, such as faults, switching operations. We have taken faults to explain the power system dynamics in our project.

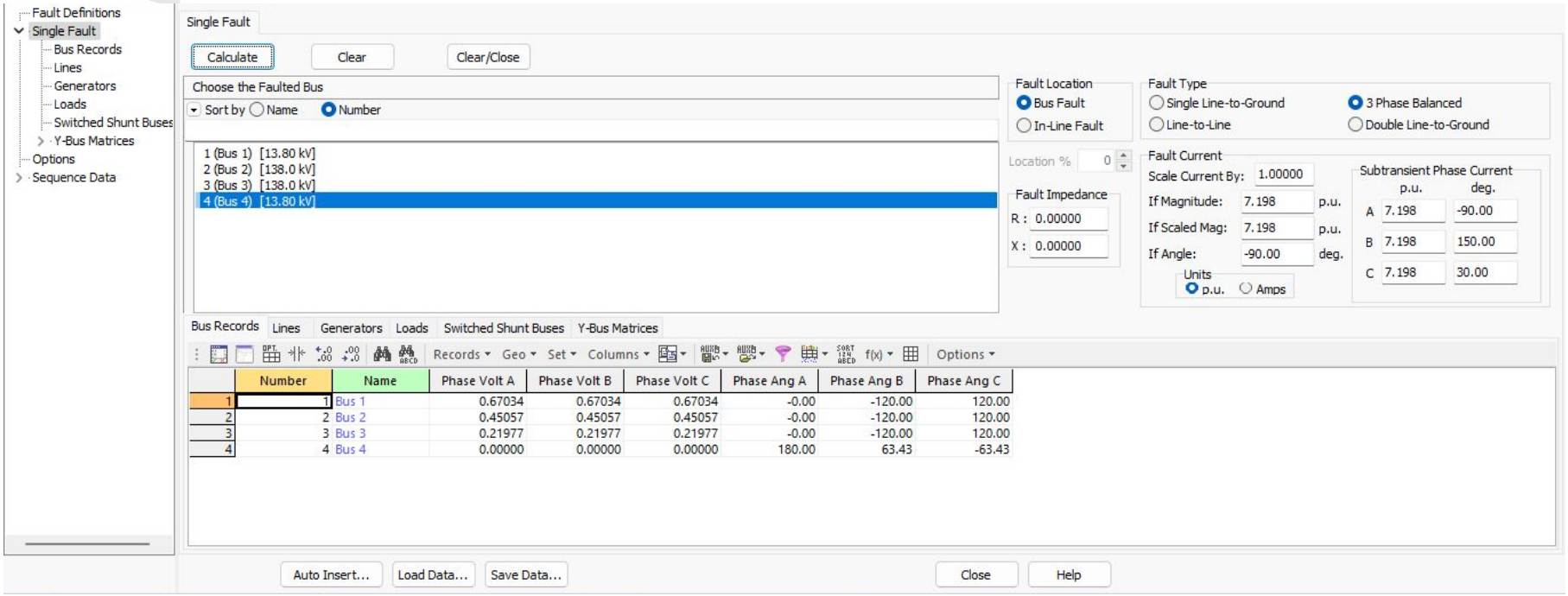
We have taken different types of symmetrical and unsymmetrical faults like LLL, LG, LL, LLG and calculated the subtransient currents for choosing the circuit breakers and analysed transient stability

We calculated the value of critical time for a 3 phase symmetrical fault.

Finding subtransient fault currents in different symmetrical and unsymmetrical faults

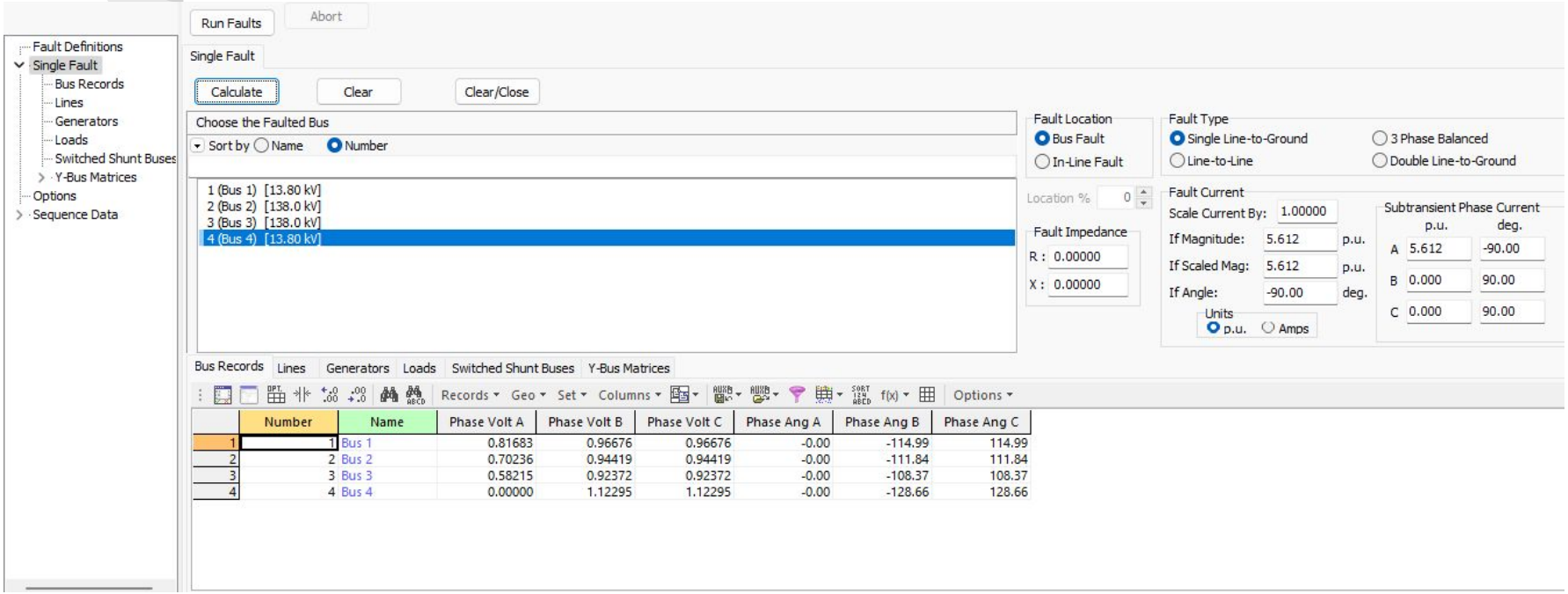
Taking this power system for computing all the fault currents (LLL, LG, LL, LLG).

3-phase Symmetrical Fault at Bus 4



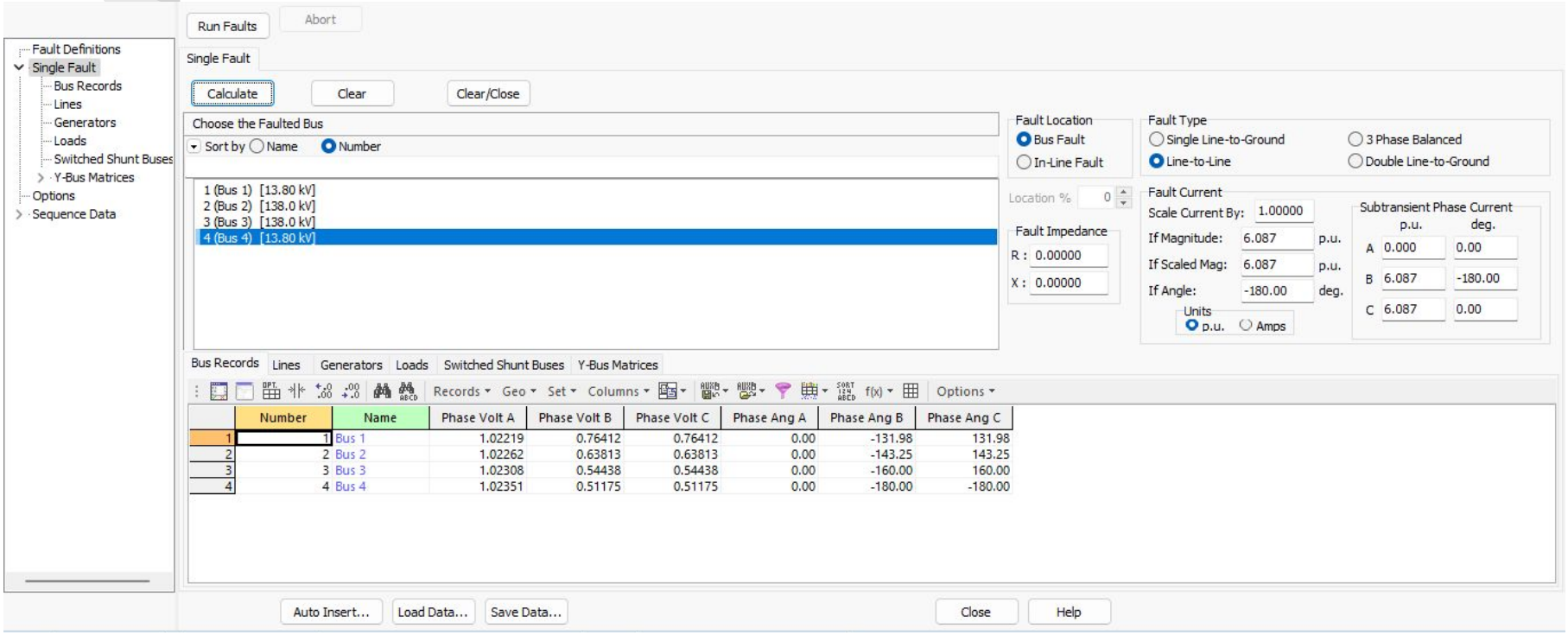
	Number	Name	Phase Volt A	Phase Volt B	Phase Volt C	Phase Ang A	Phase Ang B	Phase Ang C
1	1	Bus 1	0.67034	0.67034	0.67034	-0.00	-120.00	120.00
2	2	Bus 2	0.45057	0.45057	0.45057	-0.00	-120.00	120.00
3	3	Bus 3	0.21977	0.21977	0.21977	-0.00	-120.00	120.00
4	4	Bus 4	0.00000	0.00000	0.00000	180.00	63.43	-63.43

LG Fault at Bus 4



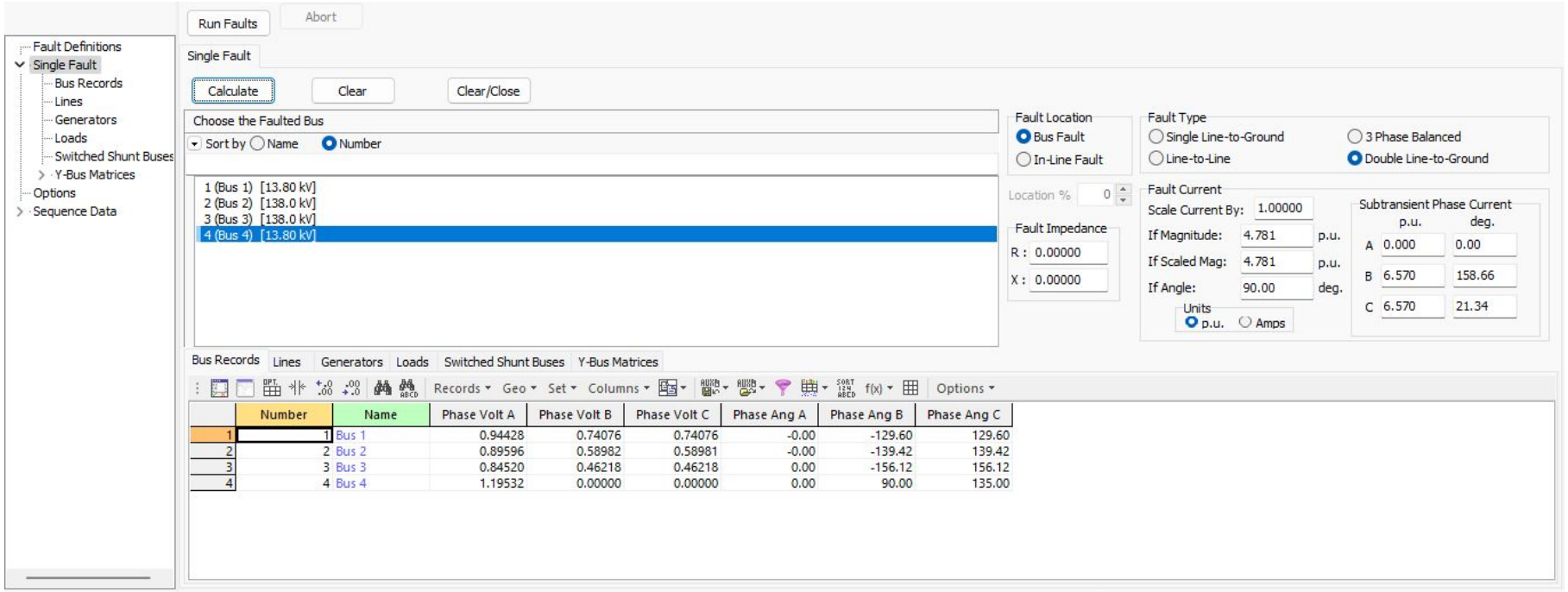
	Number	Name	Phase Volt A	Phase Volt B	Phase Volt C	Phase Ang A	Phase Ang B	Phase Ang C
1	1	Bus 1	0.81683	0.96676	0.96676	-0.00	-114.99	114.99
2	2	Bus 2	0.70236	0.94419	0.94419	-0.00	-111.84	111.84
3	3	Bus 3	0.58215	0.92372	0.92372	-0.00	-108.37	108.37
4	4	Bus 4	0.00000	1.12295	1.12295	-0.00	-128.66	128.66

LL fault at Bus 4



	Number	Name	Phase Volt A	Phase Volt B	Phase Volt C	Phase Ang A	Phase Ang B	Phase Ang C
1	1	Bus 1	1.02219	0.76412	0.76412	0.00	-131.98	131.98
2	2	Bus 2	1.02262	0.63813	0.63813	0.00	-143.25	143.25
3	3	Bus 3	1.02308	0.54438	0.54438	0.00	-160.00	160.00
4	4	Bus 4	1.02351	0.51175	0.51175	0.00	-180.00	-180.00

LLG fault at Bus 4



	Number	Name	Phase Volt A	Phase Volt B	Phase Volt C	Phase Ang A	Phase Ang B	Phase Ang C
1	1	Bus 1	0.94428	0.74076	0.74076	-0.00	-129.60	129.60
2	2	Bus 2	0.89596	0.58982	0.58981	-0.00	-139.42	139.42
3	3	Bus 3	0.84520	0.46218	0.46218	0.00	-156.12	156.12
4	4	Bus 4	1.19532	0.00000	0.00000	0.00	90.00	135.00

Transient Stability

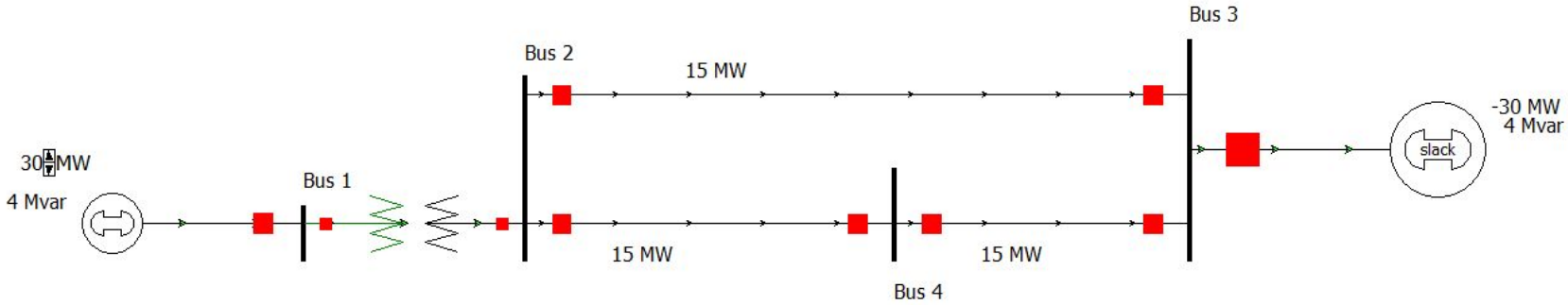
Transient stability refers to the ability of a power system to maintain synchronism and continue to operate stably after experiencing a large and sudden disturbance, such as a fault or loss of generation.

Critical Time

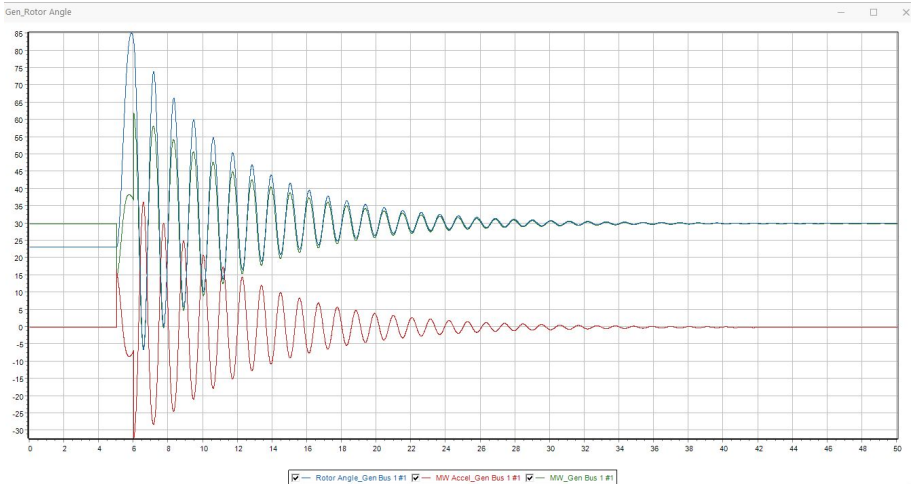
The critical time or maximum time needed by the synchronous generator to maintain the condition of the generator remains in synchronization.

We assumed that three phase symmetrical fault occur at bus 4 at t=5 seconds.

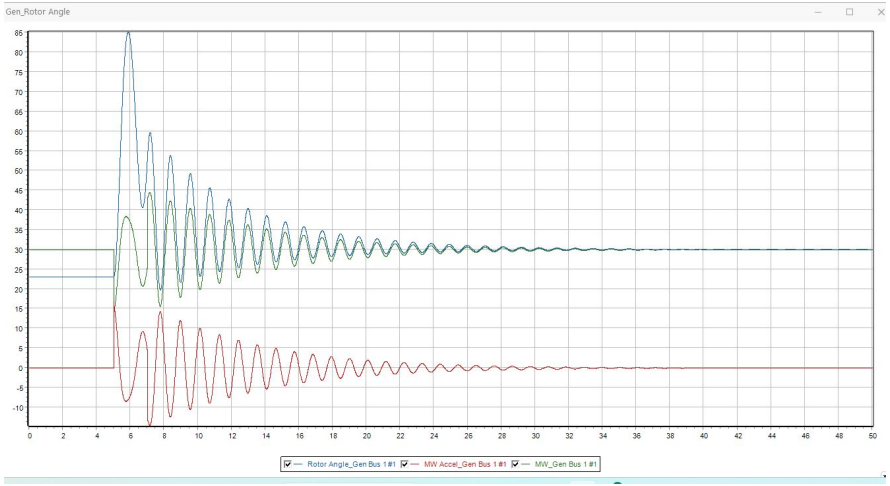
GENCC model of synchronous generator is used for analysis



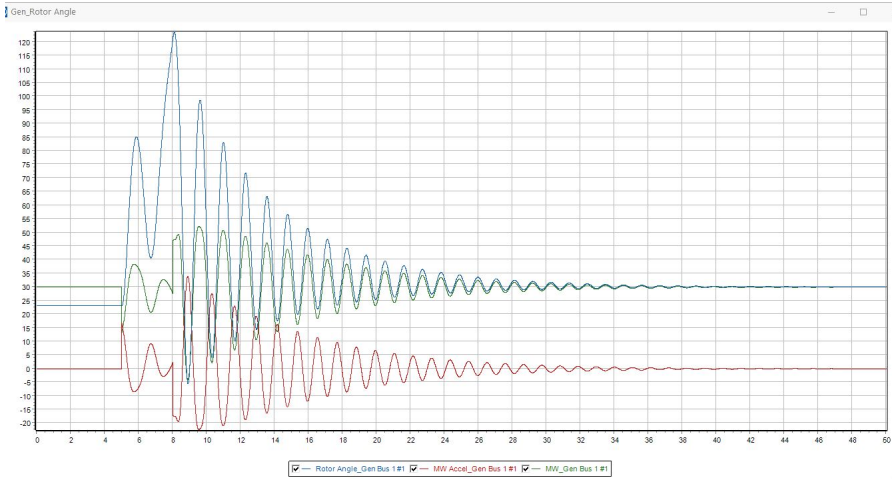
Fault time = 5 sec
Fault clearing time = 7 sec



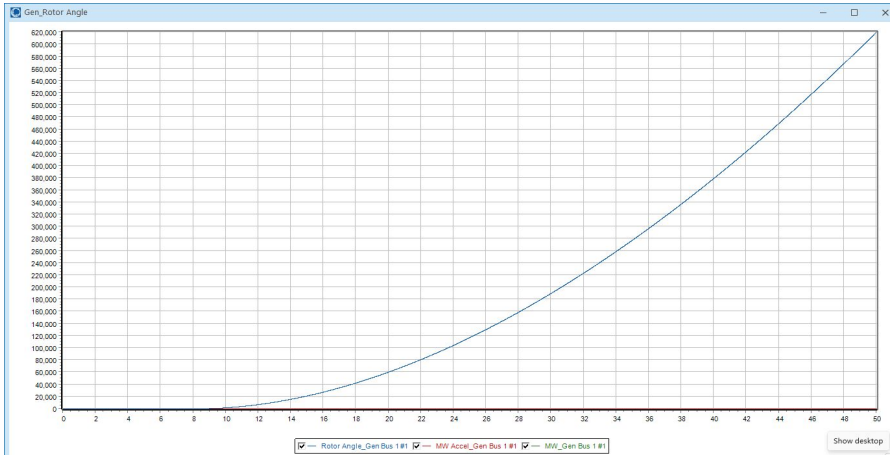
Fault time = 5 sec
Fault clearing time = 8 sec



Fault time = 5 sec
Fault clearing time = 8 sec



Fault time = 5 sec
Fault clearing time = **9 sec**



Conclusion & Analysis

Power generated	Max. No. of cycles to clear the fault	Fault occurring time(sec.)	Fault clearing time(sec.)	System Status
30 MW	180	5	8	Stable
	Above 180	5	Above 8	Unstable
40 MW	36	5	5.6	Stable
	Above 36	5	Above 5.6	Unstable
50 MW	18	5	5.3	Stable
	Above 18	5	Above 5.3	Unstable

Thank You