Title: **Dynamic Study on Wind Farm Modeling by Using OpenModelica and OpenIPSL**

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Abstract: This model is carried out by using OpenModelica and OpenIPSL Model Consists of 30 Wind Generators (WT3G) Each of Rating 2 MW. The Model consists of three different voltage levels at respective buses namely 0.7kV,35kV and 110kV.A generator is connected to 0.7kV bus and then stepped up to 35kv with the help of a 2.1 MVA transformer. 35kV is then stepped up to 110kv with the help of a 63MVA transformer Finally, 110kv buses are connected to Transmission Grid. In this model fault created at different voltage levels at respective buses namely 0.7kV,35kV,110kV observe the voltage profiles of buses during fault condition and also observe the Active and Reactive Power Responses during Fault Condition.

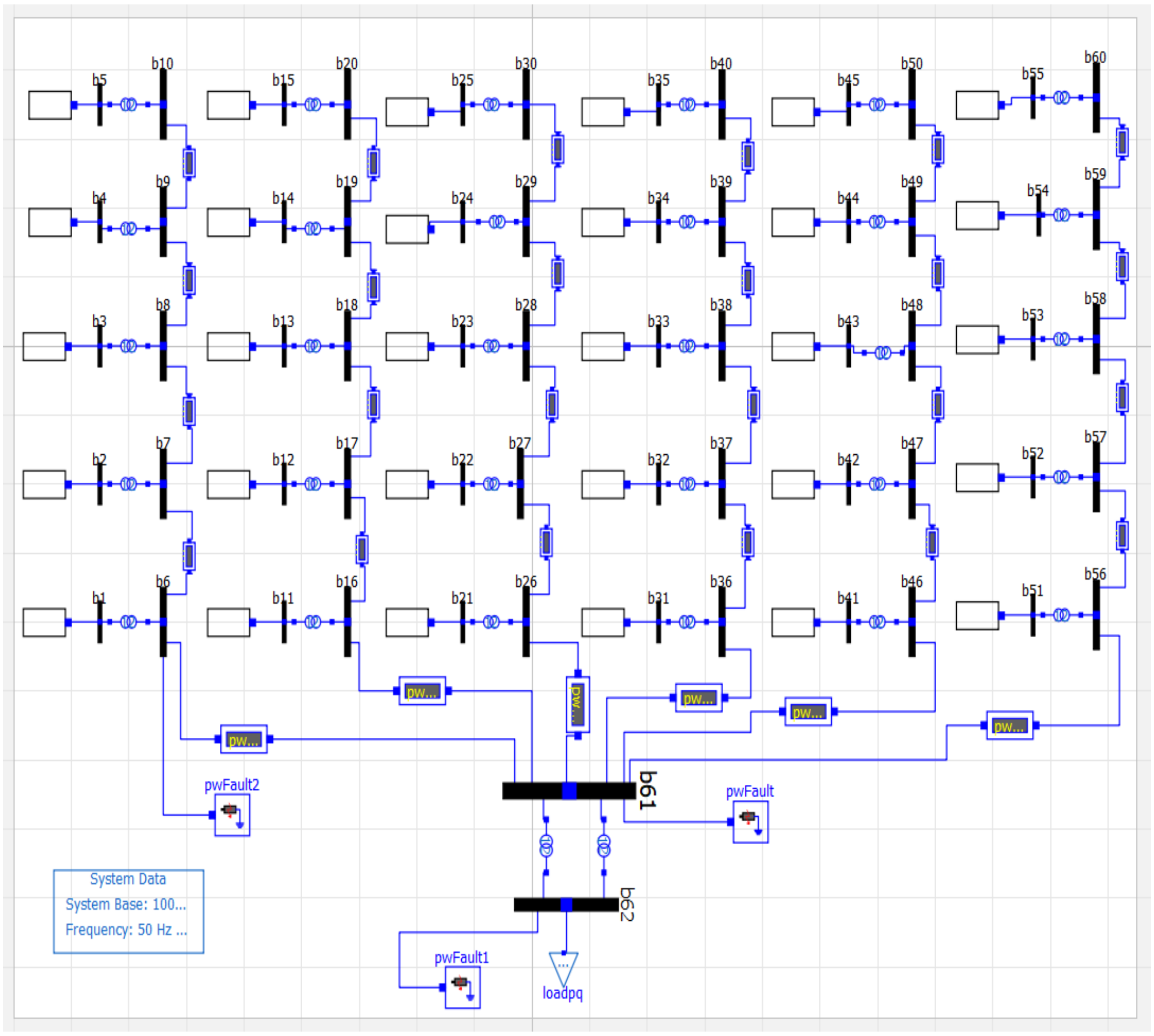

Figure 1. Implementation of 60MW Wind Farm by Using OpenIPSL

Description of the simulation:

Table 1: Model components:

Component Name	Path	Number
Bus	OpenIPSL.Electrical.Buses.Bus	62
Power Line	OpenIPSL.Electrical.Branches.PwLine	30
Generator	OpenIPSL.Electrical.Wind.PSSE.WT3G.WT3G1	30
Transformer	OpenIPSL.Electrical.Branches.PSAT.TwoWindingTransformer	32
System Data Block	OpenIPSL.Electrical.SystemBase	01
Three phase Fault	OpenIPSL.Electrical.Events.PwFault	3

The 60MW Windfarm network model is implemented in OpenModelica language using OpenIPSL package is to study the voltage stability at different buses. The system is on a 10 MVA base, the system voltage level is 0.7kV-110kV.

The simulation result of the Bus voltages of 60MW Windfarm network Model shown below:

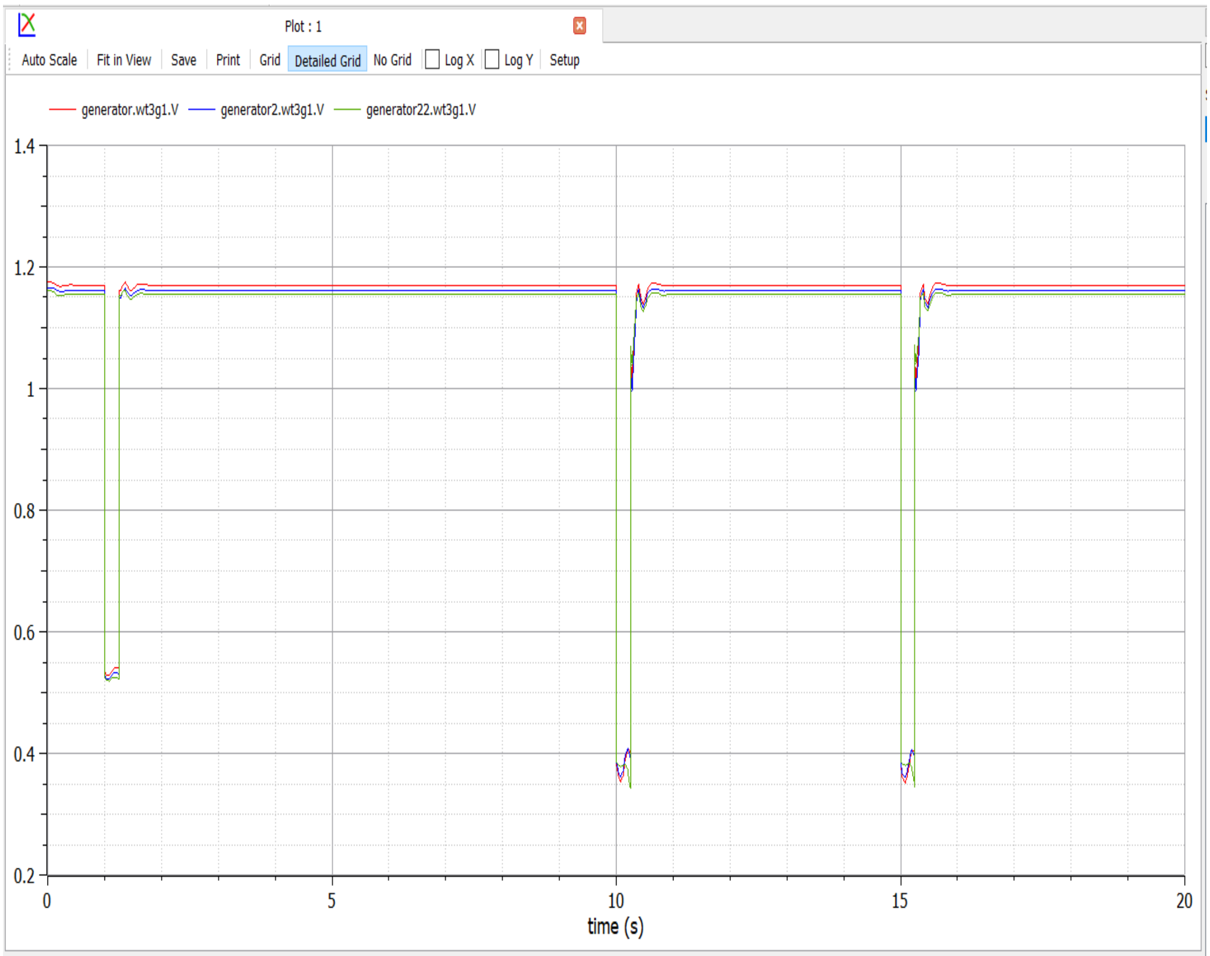

Figure 2. Voltage profiles of 60MW Windfarm

Active Power Results:

The difference between the mechanical input power and electrical output power causes an increase in the rotor speed and therefore the rotor starts to accelerate. Approximately 1-3 seconds after the fault is cleared, the power output recovers to the pre-fault value of 2 MW.

The simulation result of the Active Power Output of 60MW Windfarm network Model shown below:

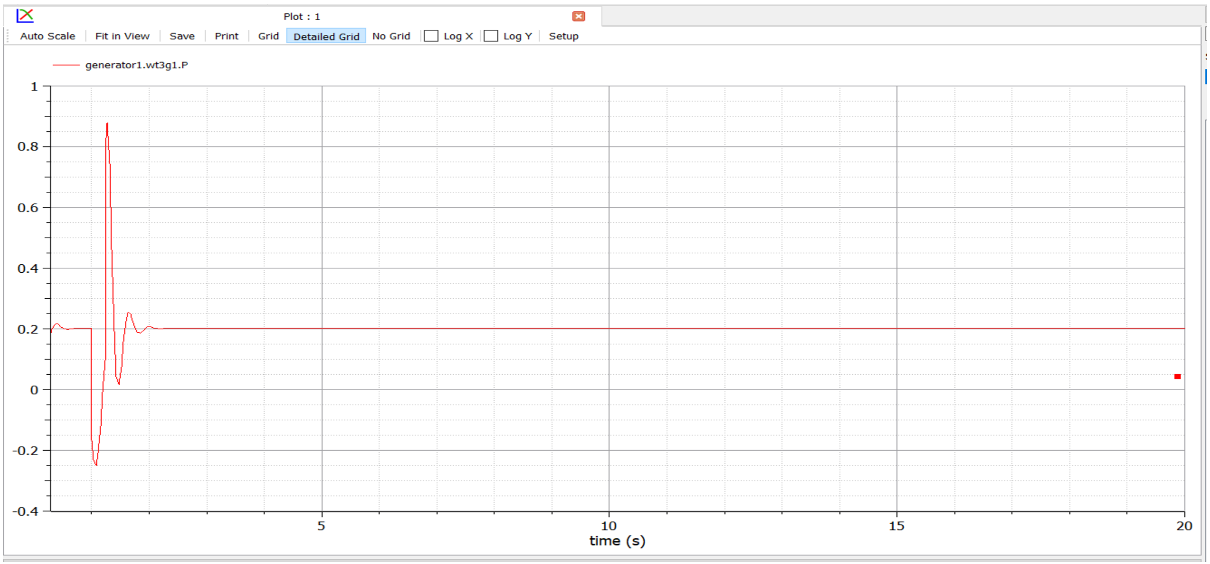

Figure 3. Active Power Output of Wind Turbine Generator (WT3G)

Reactive Power Results:

Before the fault occurs, unit generator3 was compensated, unit generator2 was injecting reactive power to the grid and unit generator1 was absorbing reactive power from the grid. During the fault, we can see that all WTG units provide reactive power support to the grid, as is required by the Wind Grid Code.

The simulation result of the Reactive Power Output of 60MW Windfarm network Model shown below:

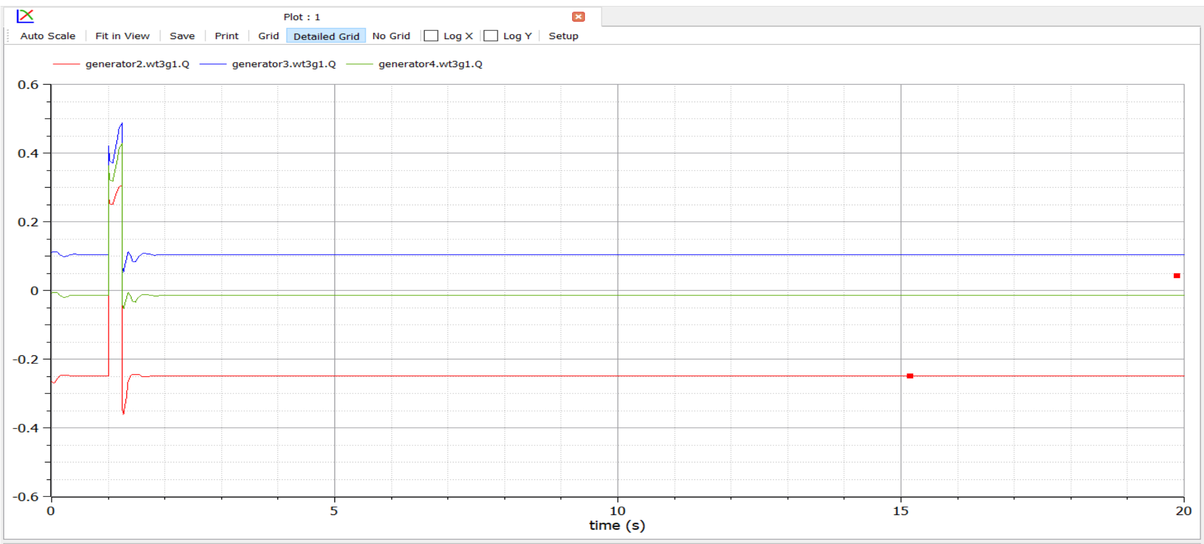

Figure 3. Reactive Power Output of Wind Turbine Generator (WT3G)

Table 2: Bus voltage magnitude (p.u.) of all buses obtained are tabulated below.

Bus No	V(p.u)	Bus No	V(p.u)
1	1	32	1
2	1	33	1
3	1	34	1
4	1	35	1
5	1	36	0.990556
6	0.990171	37	0.990304
7	0.989522	38	0.990012
8	0.988787	39	0.990099
9	0.988313	40	0.990142
10	0.988421	41	1
11	1	42	1
12	1	43	1
13	1	44	1
14	1	45	1
15	1	46	0.990556
16	0.990379	47	0.990304
17	0.990144	48	0.990012
18	0.989867	49	0.990099
19	0.989964	50	0.990142
20	0.990011	51	1
21	1	52	1
22	1	53	1
23	1	54	1
24	1	55	1
25	1	56	0.993709
26	0.990556	57	0.995817
27	0.990304	58	0.997924
28	0.990012	59	0.999585
29	0.990099	60	1.000402
30	0.990142	61	0.990766
31	1	62	0.954474

Conclusion:

The Implementation of 60MW Windfarm in Modelica represents the system behaviour before and after the fault occurs at 0.7kV,35kV and 110kV buses and also Observed the Active and Reactive Power Responses Under Fault condition.