**IEEE 13 Bus system in Simulink Phasor Domain**

* Two models are created, one with lines modelled as Distributed parameters Line (DPL) and other with lines modeled as Pi Section Line(PI)
* Voltage regulators are modelled and includes LDC
* Initial Tap settings are taken same as the benchmark document
* Runs in Phasor domain. Simulation is much faster compared to the discrete domain simulation.

**Regulator Taps and Parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| Regulator ID: | 1 |  |  |
| Line Segment: | 650 - 632 |  |  |
| Phases: | A - B -C |  |  |
| Connection: | 3-Ph,LG |  |  |
| Monitoring Phase: | A-B-C |  |  |
| Bandwidth: | 2.0 volts |  |  |
| PT Ratio: | 20 |  |  |
| Primary CT Rating: | 700 |  |  |
| Compensator Settings: | Ph-A | Ph-B | Ph-C |
| R - Setting: | 3 | 3 | 3 |
| X - Setting: | 9 | 9 | 9 |
| Voltage Level (Vref): | 122 | 122 | 122 |
| Time Delay Assumed(s): | 10 | 10 | 10 |

**Comparison of Steady state voltages and Substation Power**

|  |  |  |  |
| --- | --- | --- | --- |
| **Substation Active Power (KW)** | **Phase a** | **Phase b** | **Phase c** |
| Benchmark | 1251.398 | 977.332 | 1348.461 |
| Simulink DPL | 1227 | 1016 | 1329 |
| Simulink PI | 1228 | 1015 | 1331 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Substation Reactive Power (KVar)** | **Phase a** | **Phase b** | **Phase c** |
| Benchmark | 681.570 | 373.418 | 669.784 |
| Simulink DPL | 670 | 402.8 | 666.7 |
| Simulink PI | 674.6 | 401.3 | 665.6 |

|  |  |
| --- | --- |
| **Tap Setting** | **Regulator 1** |
| Benchmark | 10 8 11 |
| Simulink(Initial) | 10 8 11 |
| Simulink(Final) | 10 8 11 |

**Phase A Voltage**

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**Phase B Voltage**

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**Phase C Voltage**

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**% Error Voltage**

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|  |  |  |  |
| --- | --- | --- | --- |
| **Max Error pu** | **Phase a** | **Phase b** | **Phase c** |
| Simulink DPL | 0.0047 | 0.0077 | 0.0044 |
| Simulink PI | 0.0034 | 0.0124 | 0.0053 |

The main reason for the difference in voltage compared to benchmark is due to the assumptions and approximations taken as given below

* Dynamic Simulation in Simulink will consider all Loads as Constant Impedance Loads