

Figure 1: Slightly Modified Kundur System.

**System Information**

```
genrou 1 "1" 22.00 "1" : #9 mva=900.00 ... "h" 6
genrou 2 "2" 22.00 "1" : #9 mva=900.00 ... "h" 3.5
genrou 3 "3" 22.00 "1" : #9 mva=900.00 ... "h" 4
genrou 4 "4" 22.00 "1" : #9 mva=900.00 ... "h" 3
```

	R	T1	T2	T3
tgov1 1 "1" 22.00 "1" : #1 mwcap=900.0000	0.05	0.50	1.00	15.00
tgov1 2 "2" 22.00 "1" : #1 mwcap=400.0000	0.04	0.50	3.00	10.00
tgov1 3 "3" 22.00 "1" : #1 mwcap=800.0000	0.05	0.40	3.00	10.00

(exciter the same for all gens)

```
sexs 1 "1" 22.00 "1" : #9 1.0 5.0 1000.0 0.05 -5.0 5.0 0.1 0.0 -5.0 5.0 0.0
```

....

At t = 0:

Load on bus 7 = 500 P, 100 Q

Load on bus 9 = 900 P, 100 Q

All Gens approx 350 Pgen, 88 Qgen

approx 200 MW Interchange from Area 1 to Area 2 (left to right)

**General Speed up:**

LTD 2 second time step  $\approx$ 10x faster than PSDS.

LTD 1 second time step  $\approx$ 5x faster than PSDS.

**Step Test:** Load on Bus 9 +30% (270 MW step) at t=2

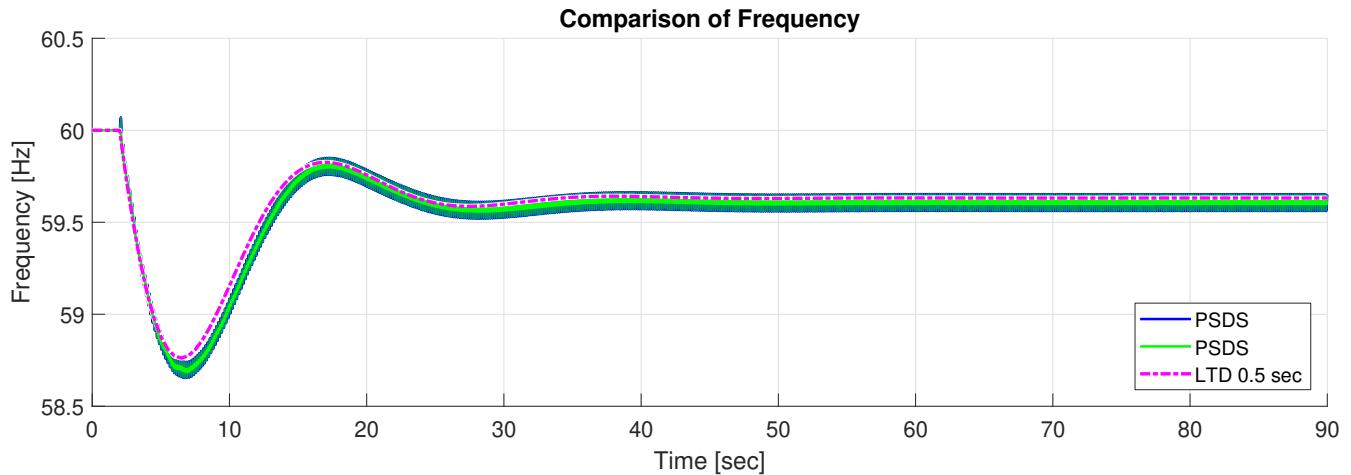


Figure 2: System frequency response.

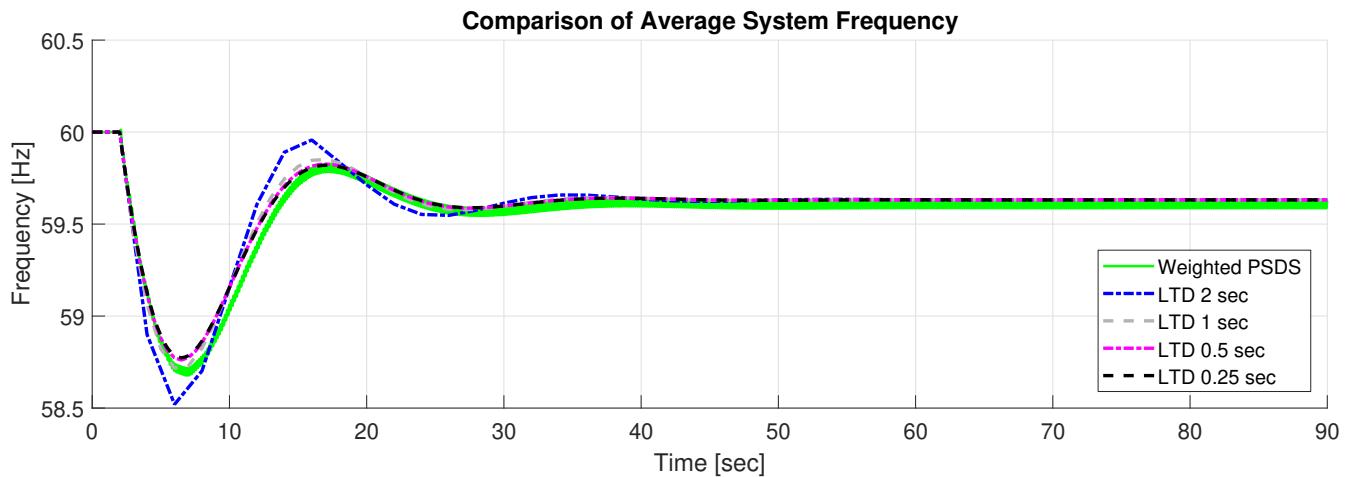


Figure 3: Average frequency.

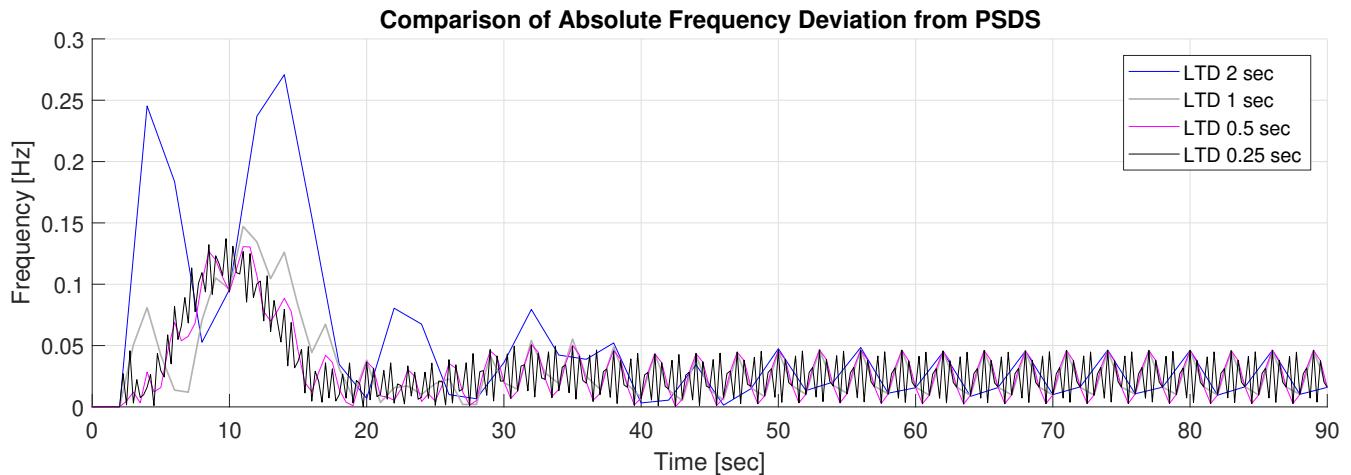


Figure 4: Relative Hz difference of PSDS - LTD (i.e.  $|f_{PSDS}(t) - f_{LTD}(t)| \times 60\text{Hz}$ ).

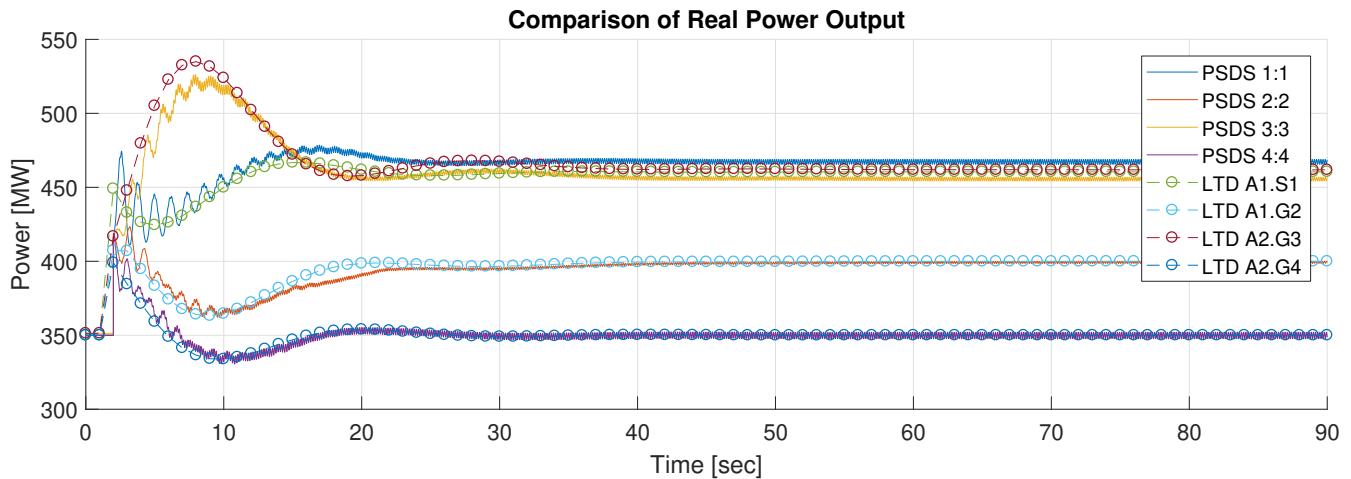


Figure 5: Electrical Power Output

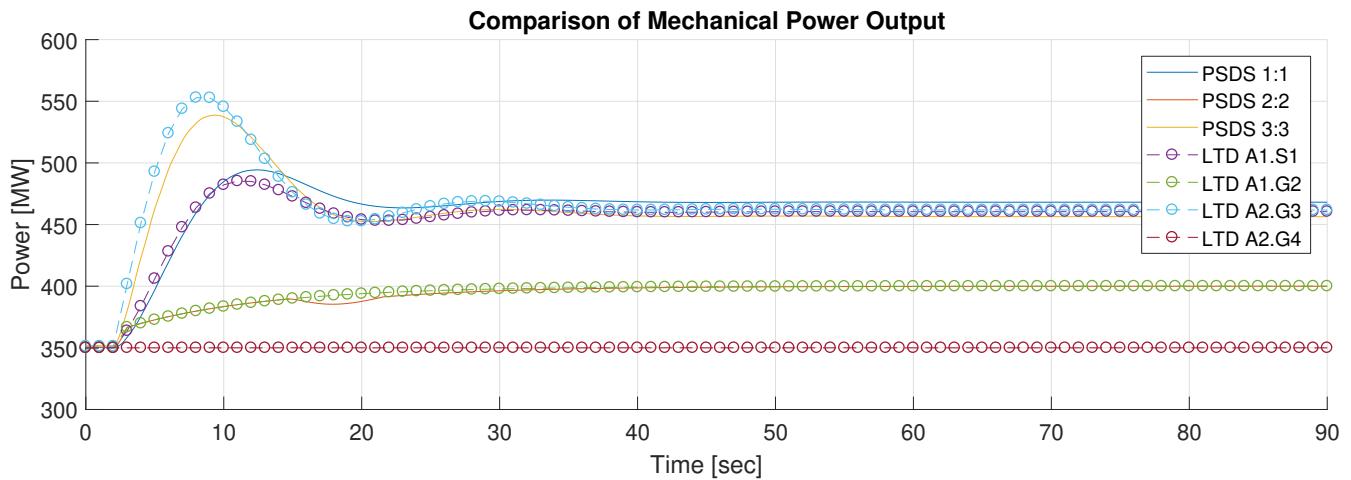


Figure 6: Generator Mechanical Power Output

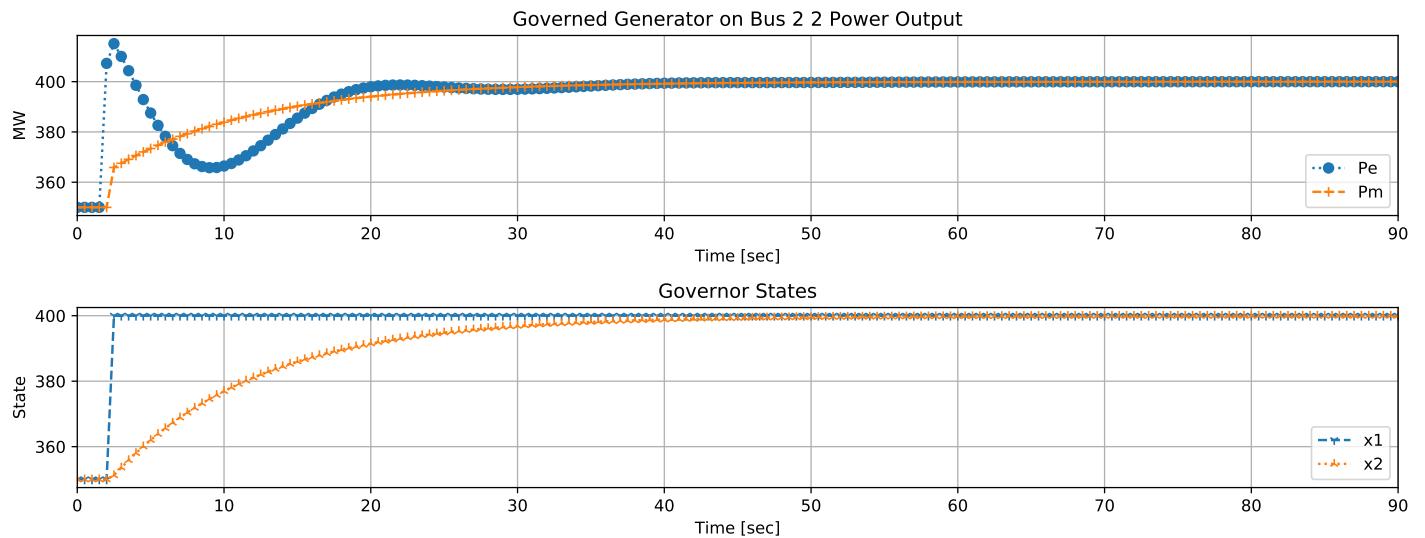


Figure 7: Dynamic state information of Generator 2.

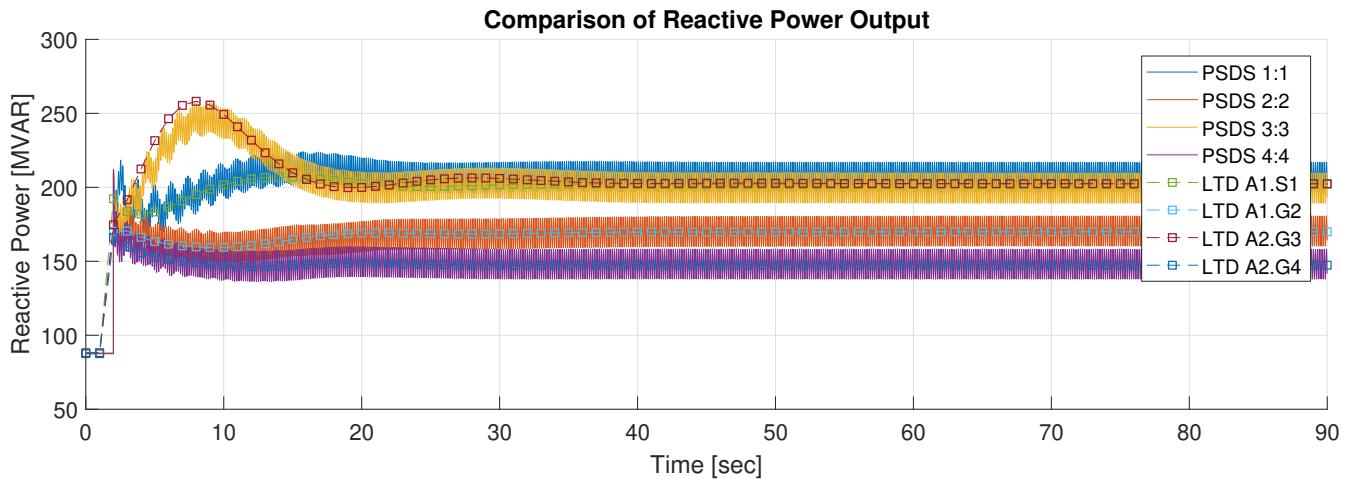


Figure 8: Reactive Power Output

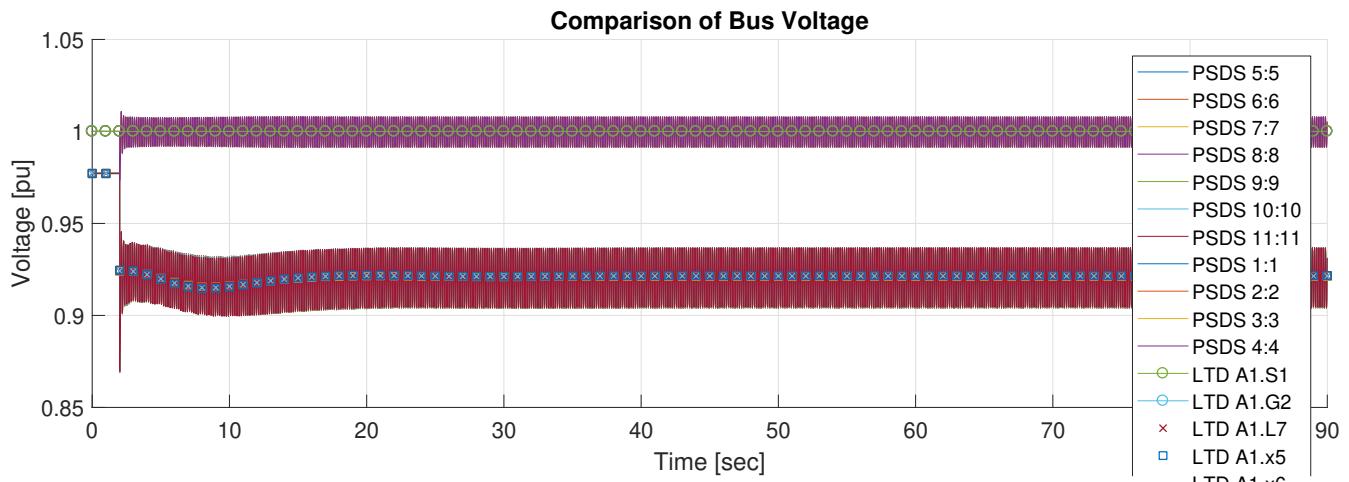


Figure 9: System Bus Voltages

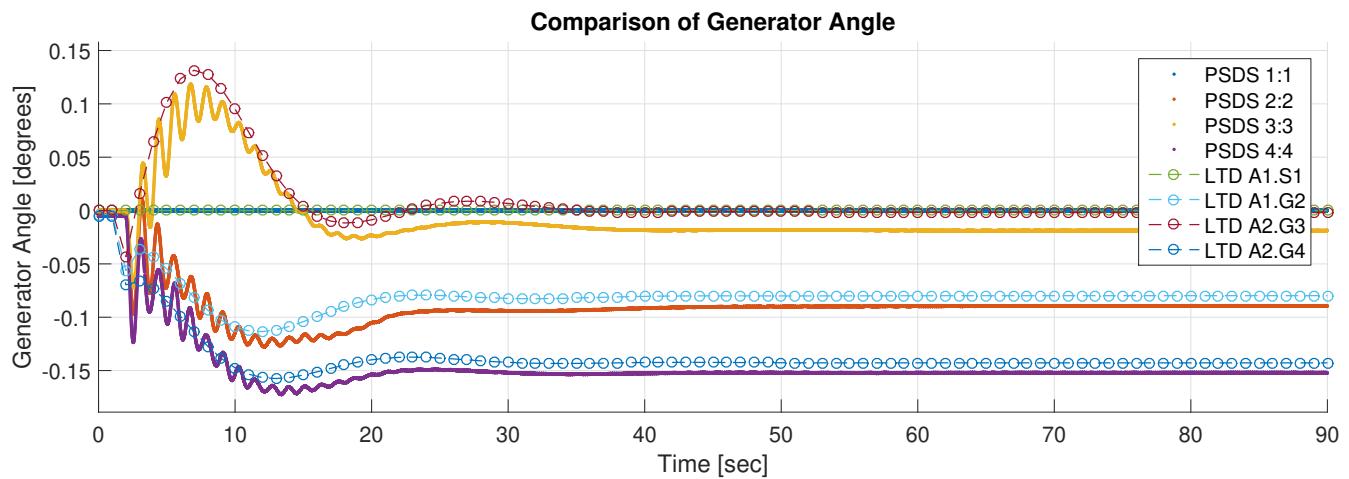


Figure 10: Generator Angles

**Ramp Test:** Load on Bus 9 +30% (270 MW) from t=2 to 42.

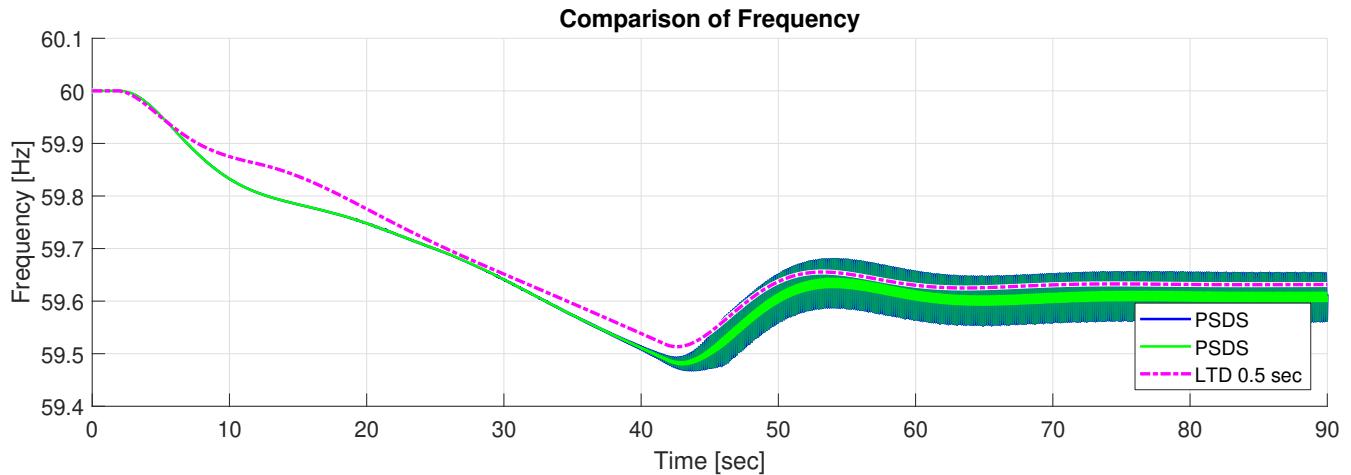


Figure 11: System frequency response.

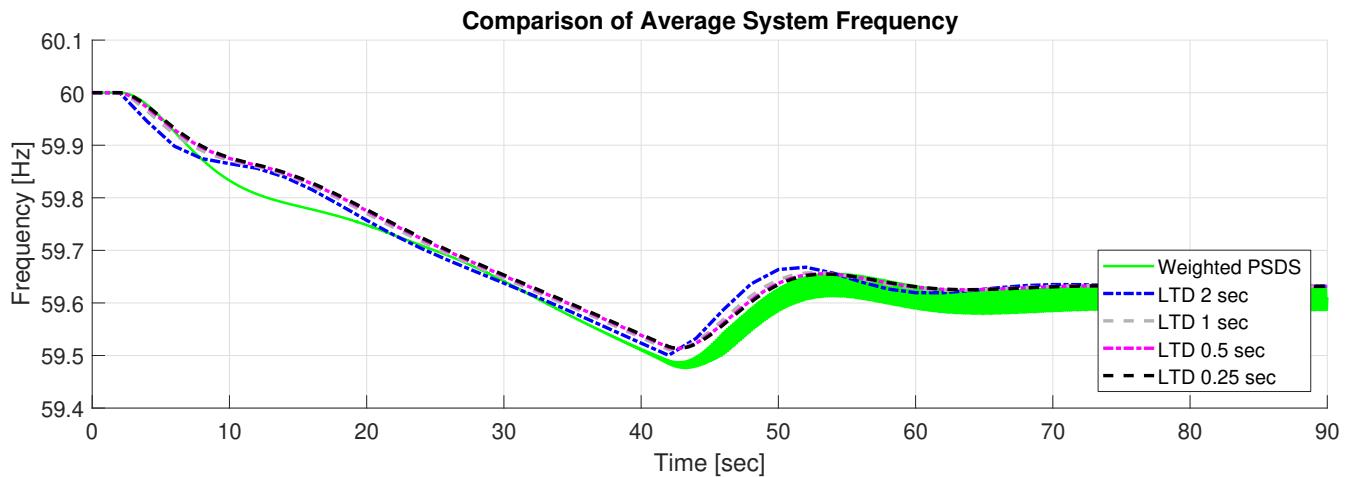


Figure 12: Average frequency.

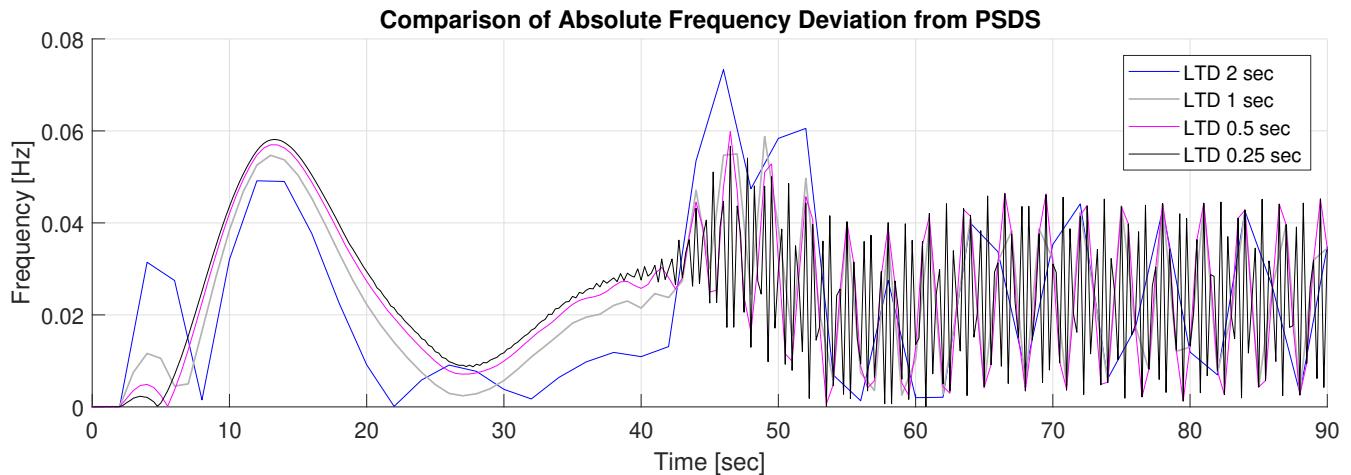


Figure 13: Relative Hz difference of PSDS - LTD (i.e.  $|f_{PSDS}(t) - f_{LTD}(t)| \times 60\text{Hz}$ ).

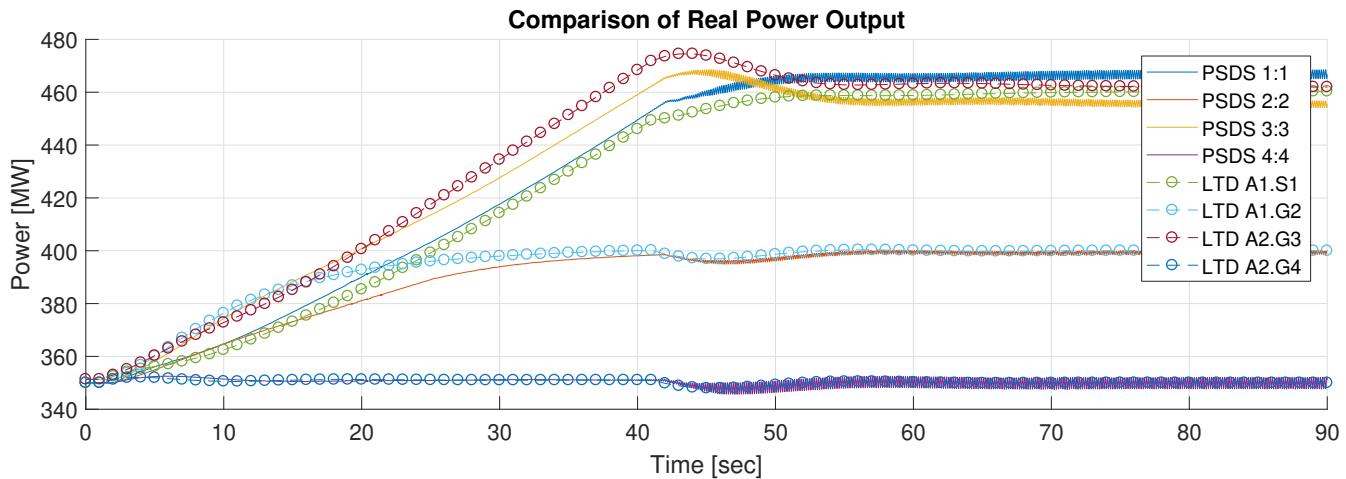


Figure 14: Electrical Power Output.

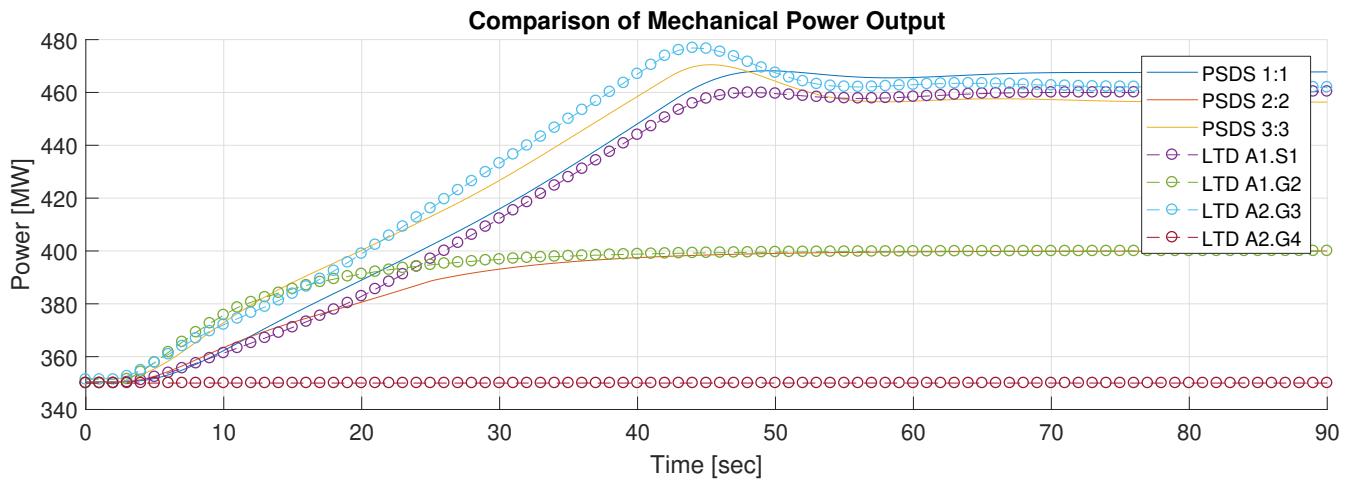


Figure 15: Generator Mechanical Power Output

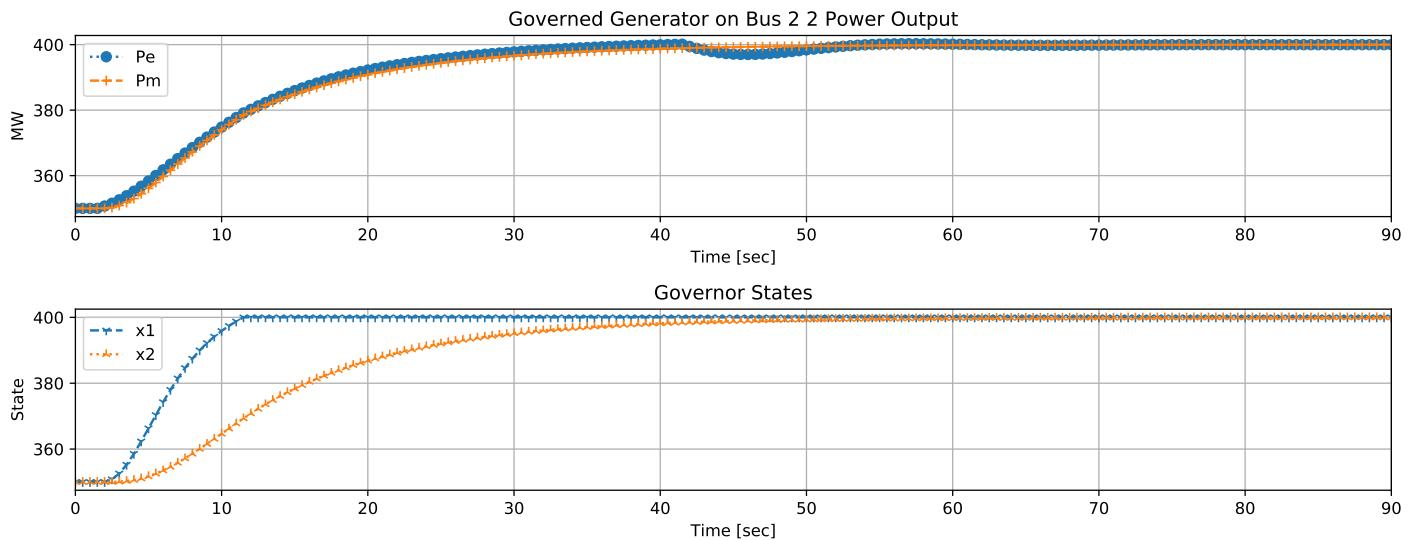


Figure 16: Dynamic state information of Generator 2.

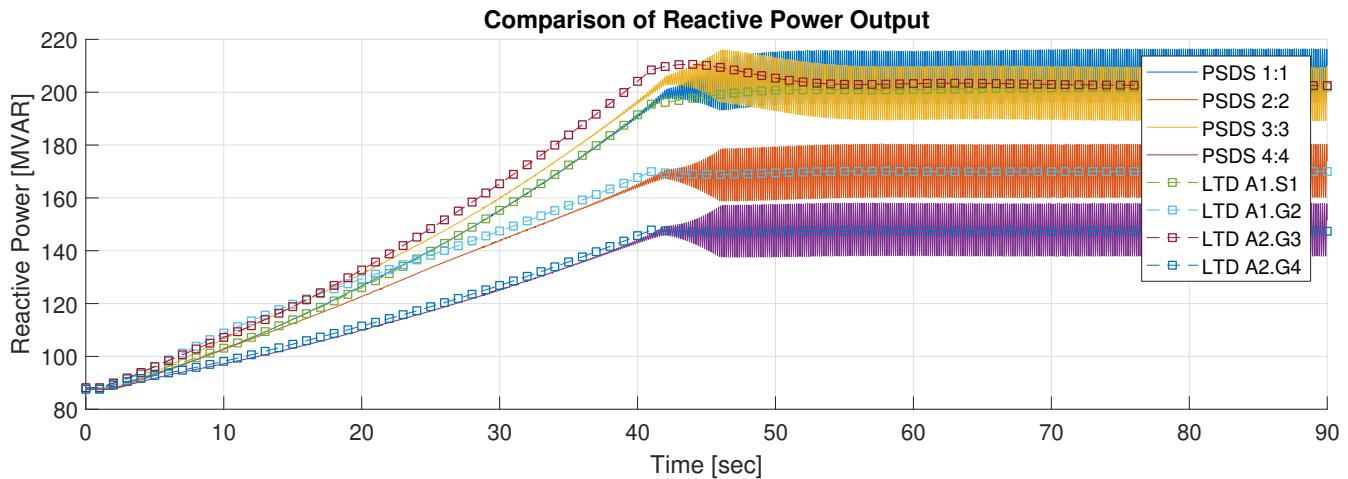


Figure 17: Reactive Power Output

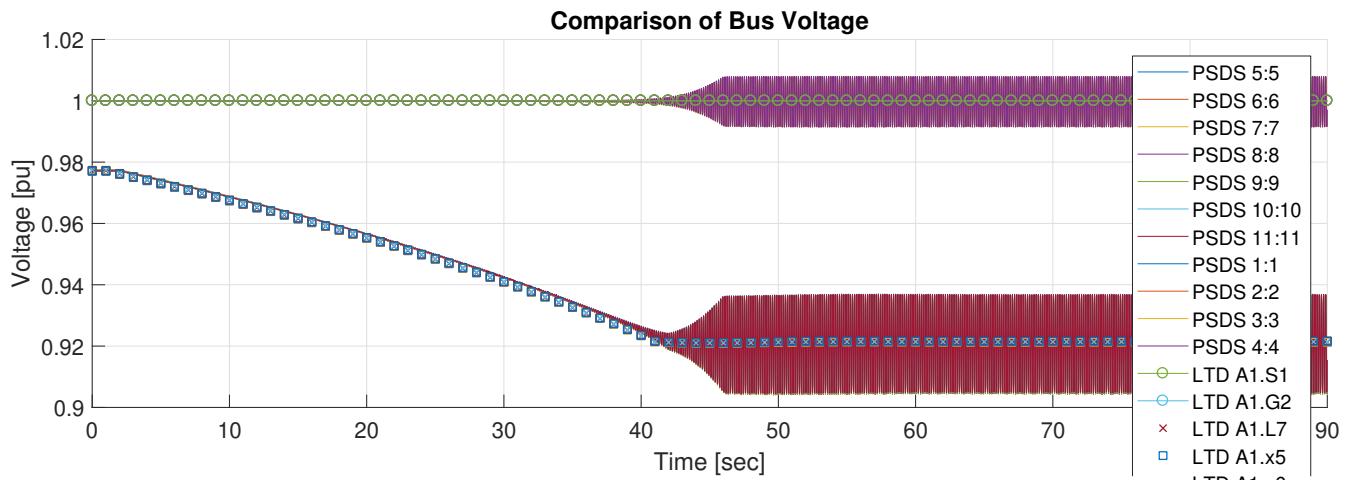


Figure 18: System Bus Voltages

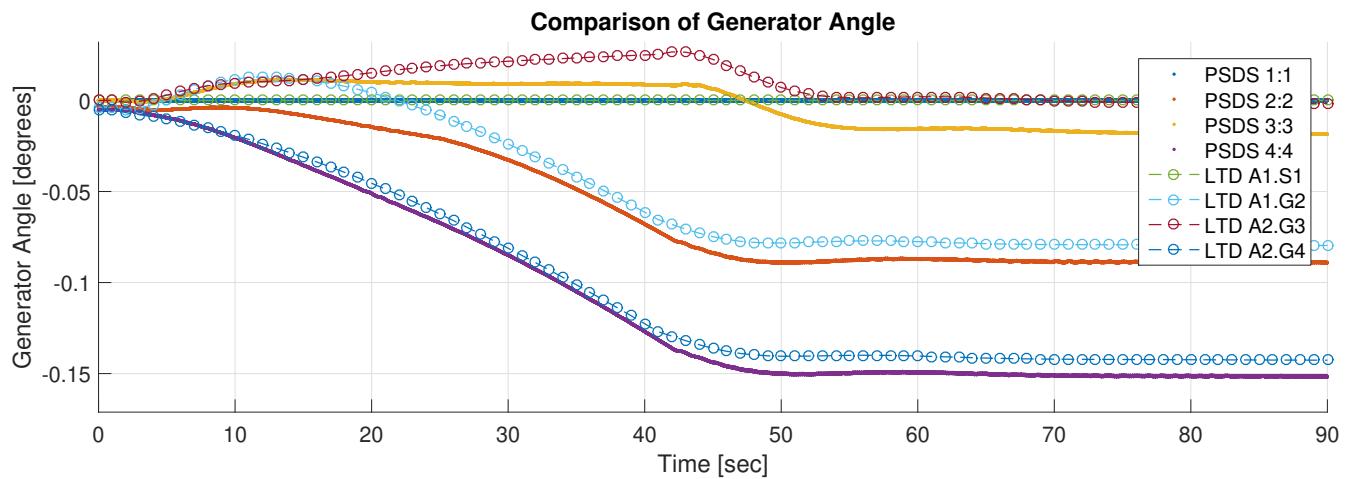


Figure 19: Generator Angles