

Figure 1: Slightly Modified Kundur System.

System Information

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#   generators
genrou  1 "1" 22.00 "1" : #9 mva=600.00 ... "h" 6 "d" 0.0000 ... "ra" 0.0000 ...
genrou  2 "2" 22.00 "1" : #9 mva=800.00 ... "h" 4 "d" 0.0000 ... "ra" 0.0000 ...
genrou  3 "3" 22.00 "1" : #9 mva=1100.00 ... "h" 3 "d" 0.0000 ... "ra" 0.0000 ...
genrou  4 "4" 22.00 "1" : #9 mva=900.00 ... "h" 4 "d" 0.0000 ... "ra" 0.0000 ...

#   exciters
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
sexs    2 "2" 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
sexs    3 "3" 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
sexs    4 "4" 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

#   governors
                    R      T1      T2      T3
tgov1 1 "1" 22.00 "1" : #1 mwcap=450.00 0.040 0.4 1.00 0.0 3.0000 10.0000 0.0
tgov1 2 "2" 22.00 "1" : #1 mwcap=500.00 0.050 0.4 1.00 0.0 3.0000 10.0000 0.0
tgov1 3 "3" 22.00 "1" : #1 mwcap=700.00 0.030 0.4 1.00 0.0 3.0000 10.0000 0.0

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At t = 0:

Load on bus 7 = 400 P, 100 Q

Load on bus 9 = 500 P, 100 Q

Slack 240 Pgen 31 Qgen

All other Gens approx 220 Pgen, 26 Qgen

approx 60 MW Interchange from Area 1 to Area 2 (left to right)

Step Test: Load on Bus 9 -30% at t=2

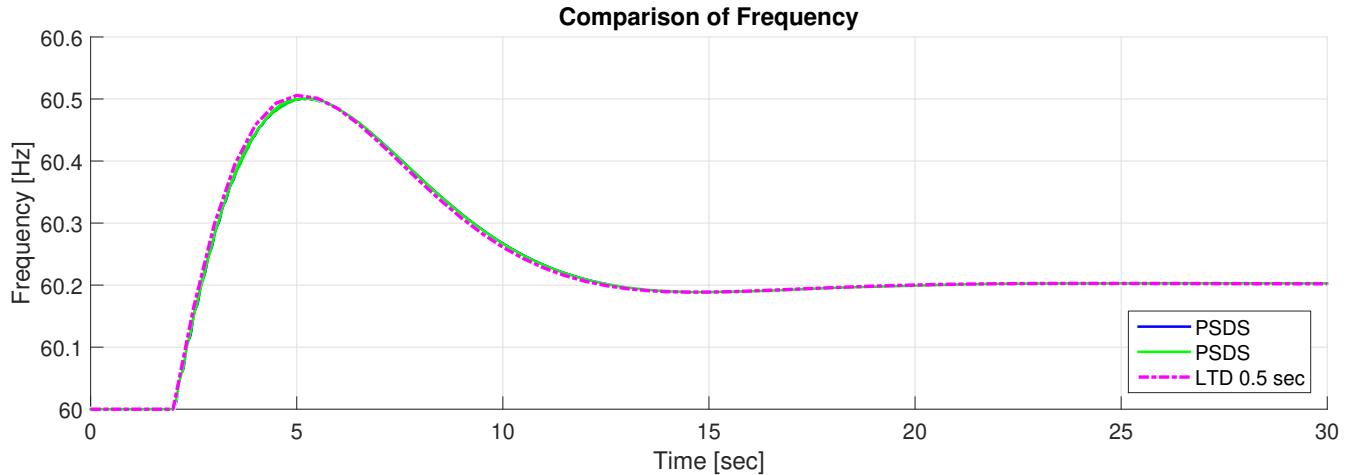


Figure 2: System frequency response.

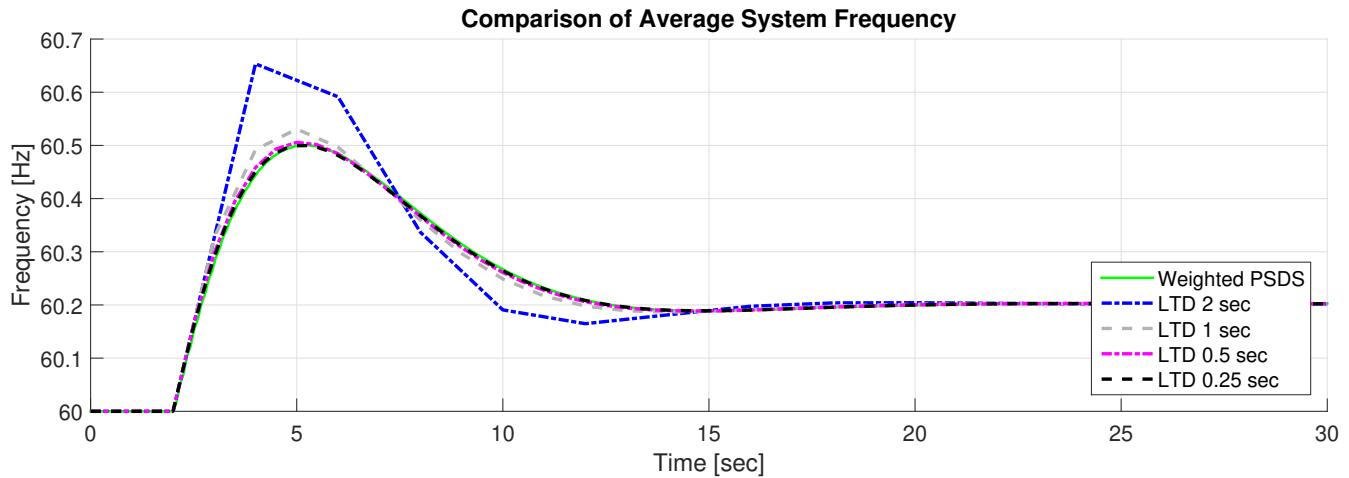


Figure 3: Average frequency.

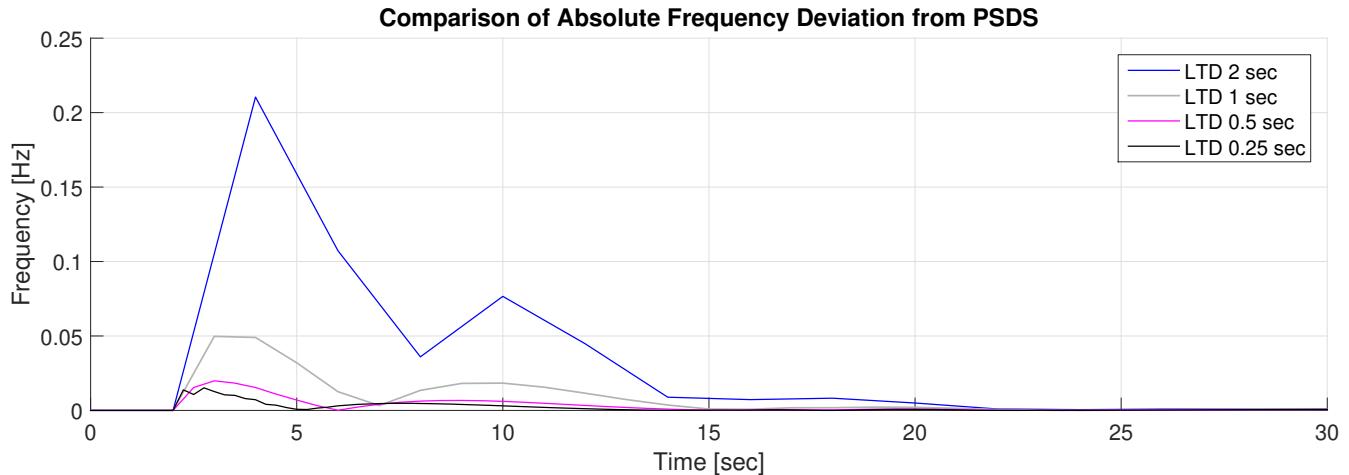


Figure 4: Relative Hz difference of PSDS - LTD (i.e. $|f_{PSDS}(t) - f_{LTD}(t)| \times 60\text{Hz}$).

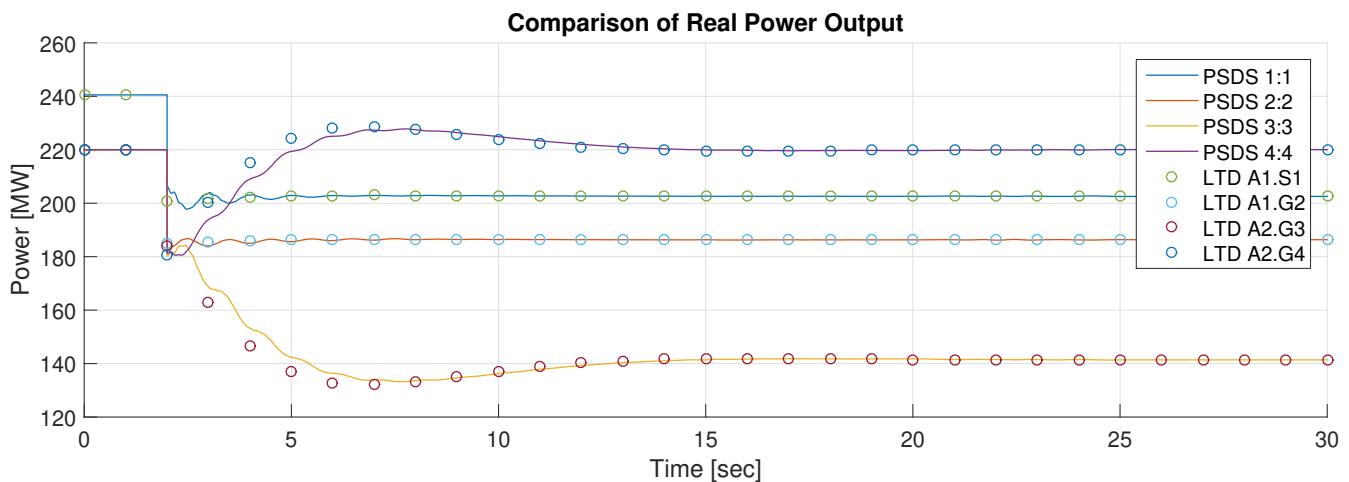


Figure 5: Electrical Power Output

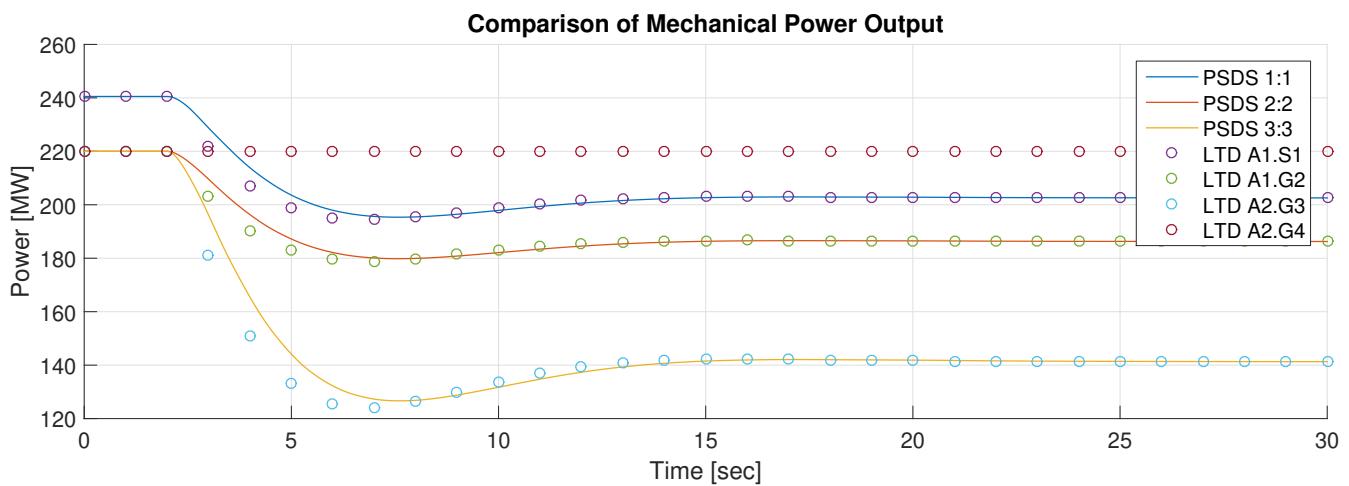


Figure 6: Generator Mechanical Power Output

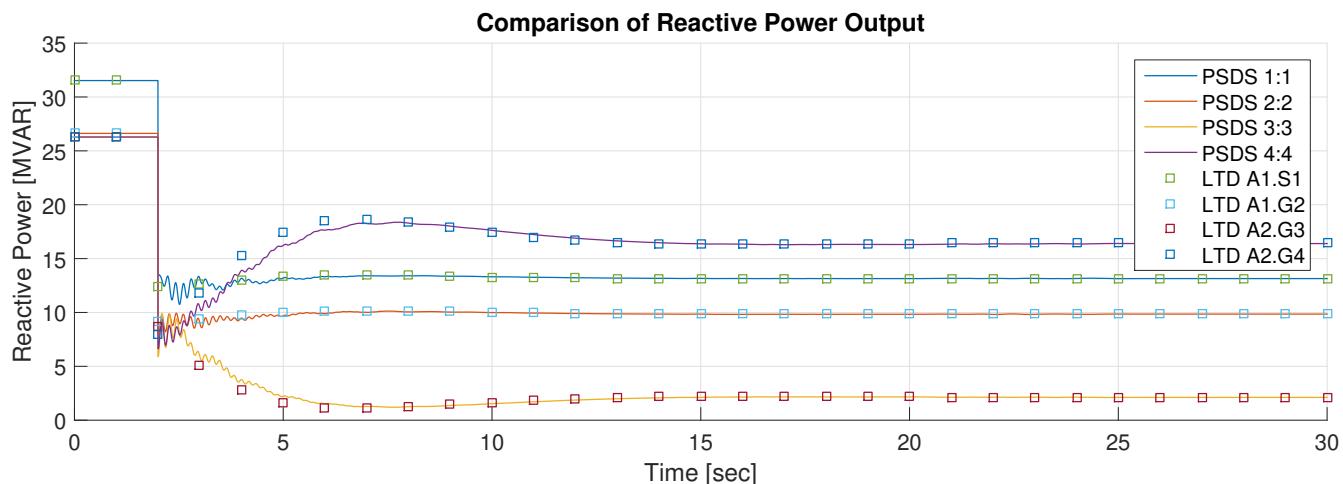


Figure 7: Reactive Power Output

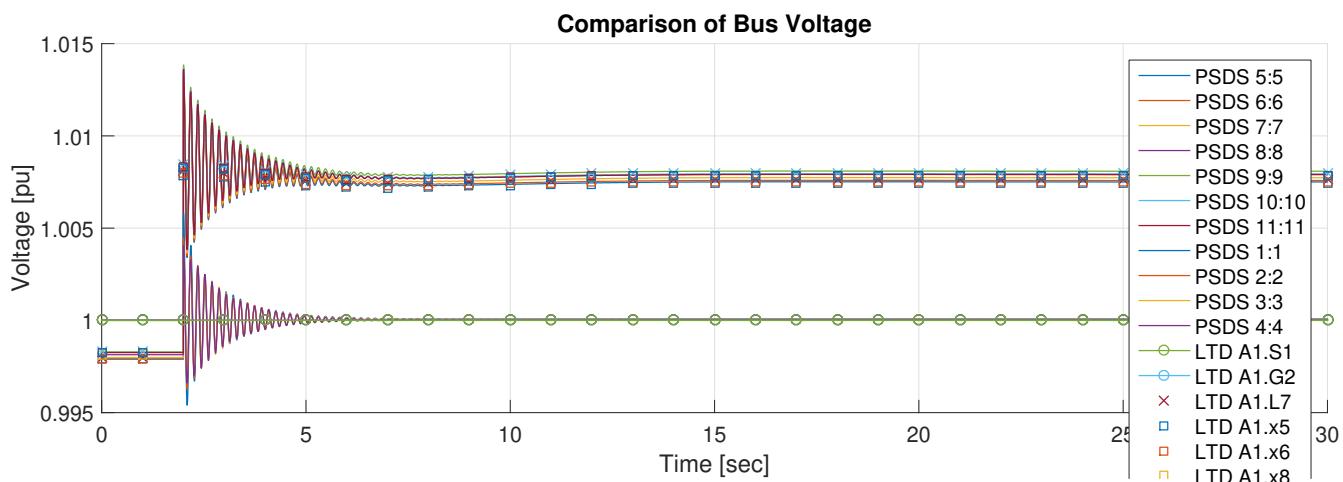


Figure 8: System Bus Voltages

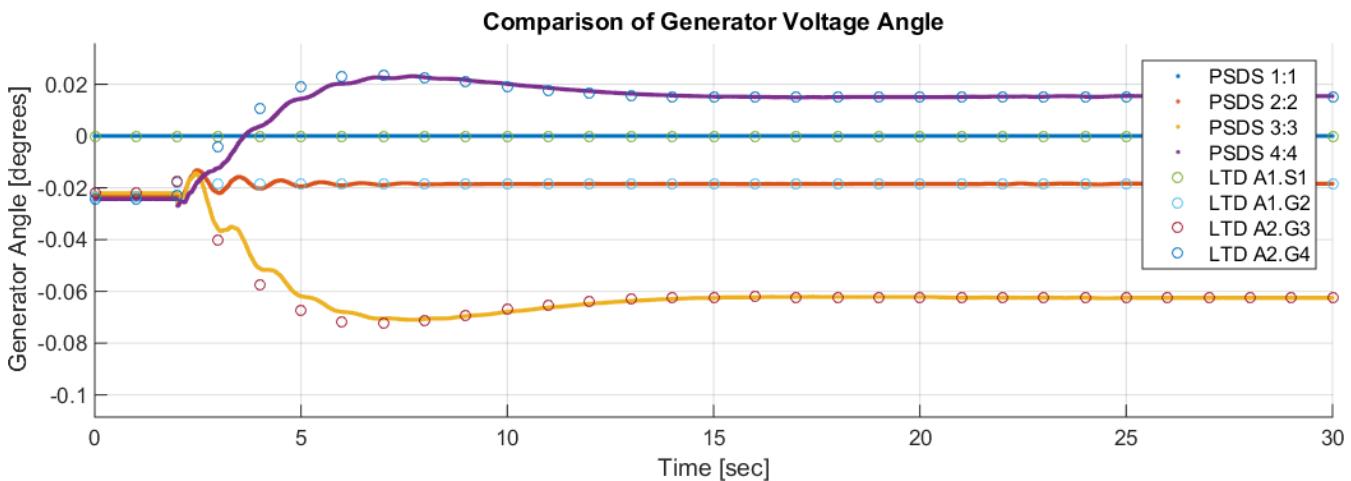


Figure 9: Generator Angles

Ramp Test: Load on Bus 9 -30% from t=2 to 42.

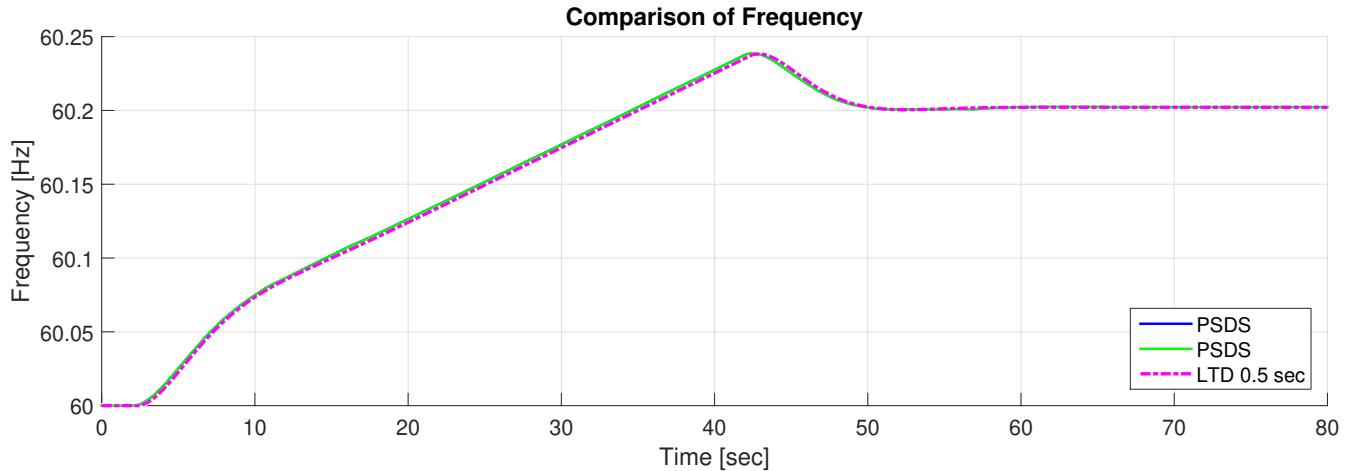


Figure 10: System frequency response.

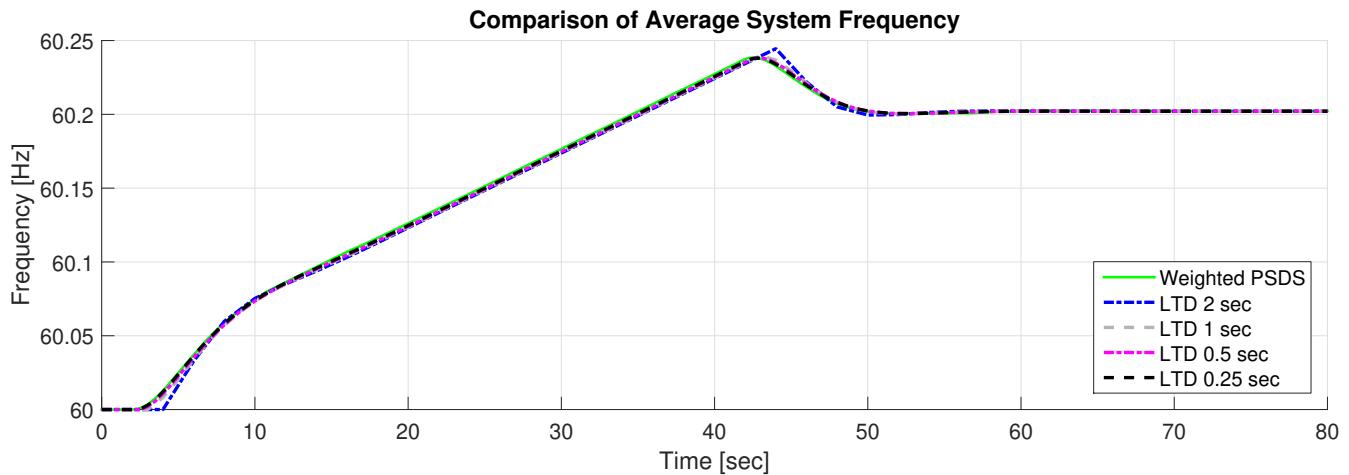


Figure 11: Average frequency.

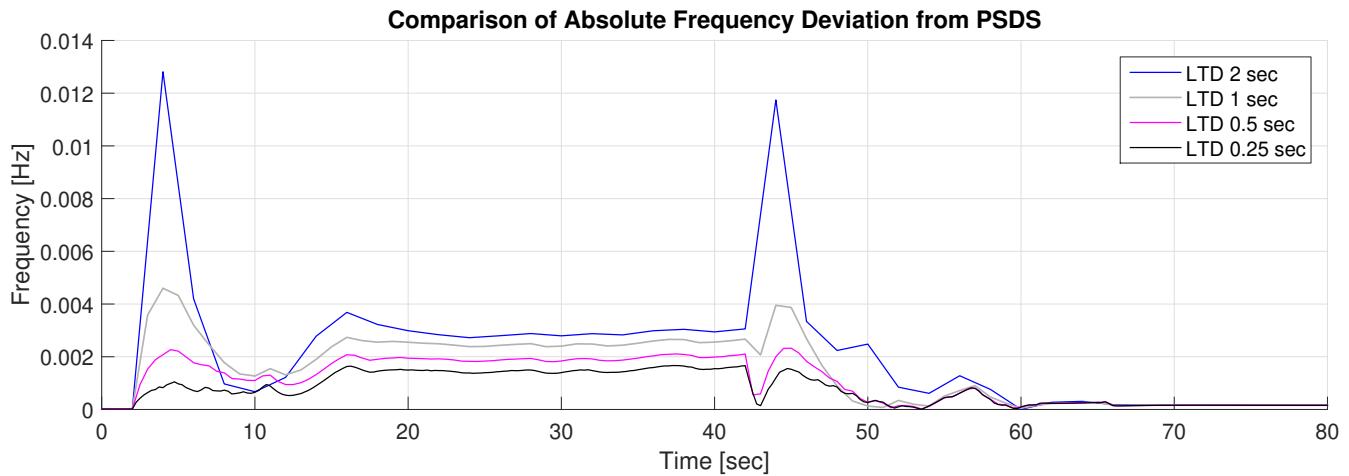


Figure 12: Relative Hz difference of PSDS - LTD (i.e. $|f_{PSDS}(t) - f_{LTD}(t)| \times 60\text{Hz}$).

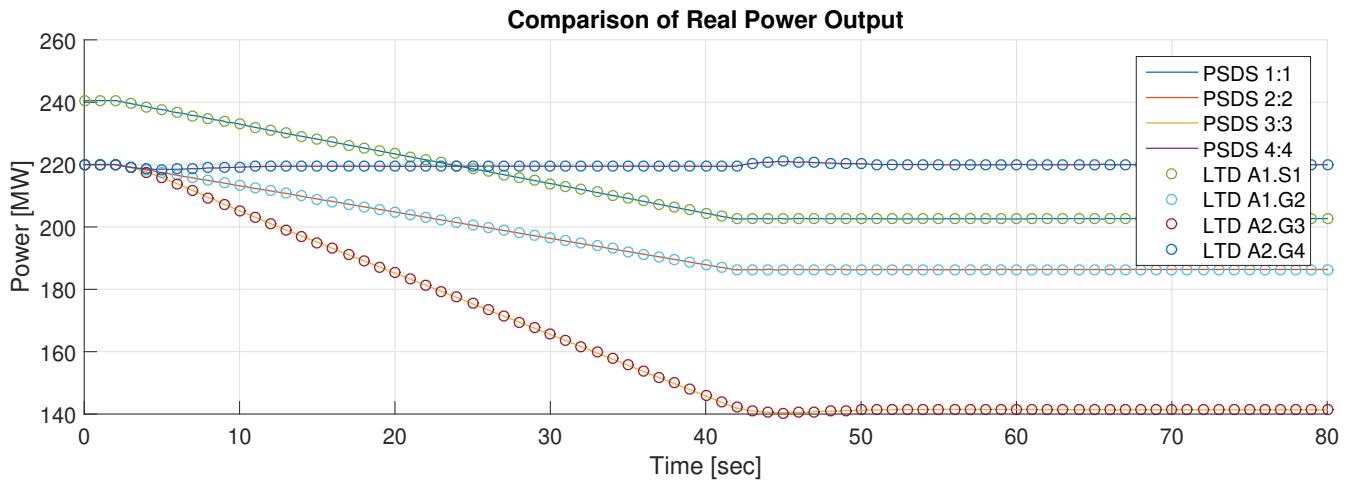


Figure 13: Electrical Power Output.

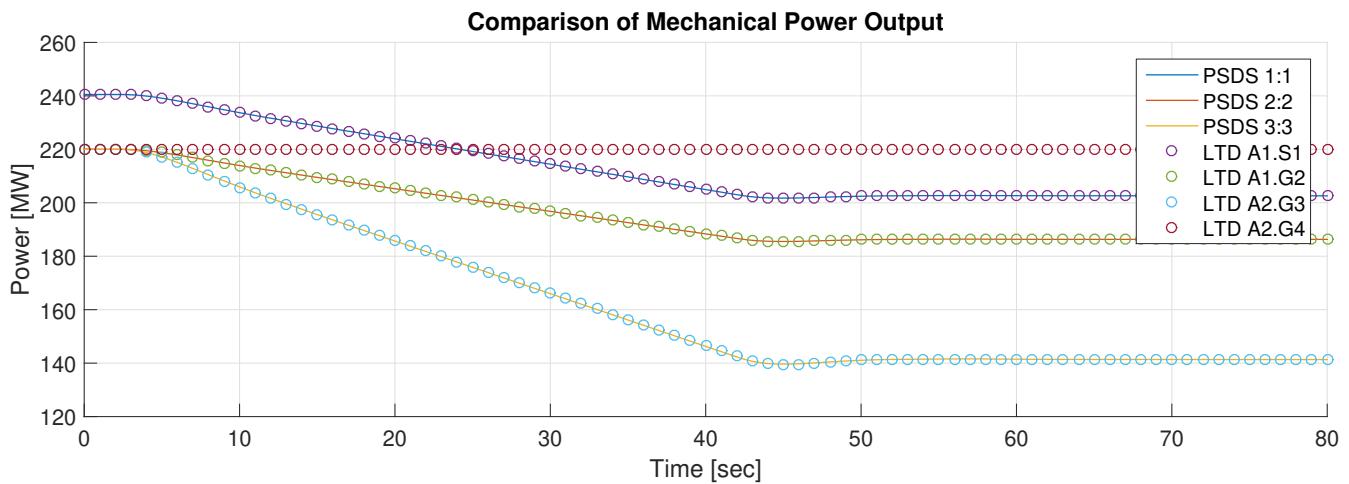


Figure 14: Generator Mechanical Power Output

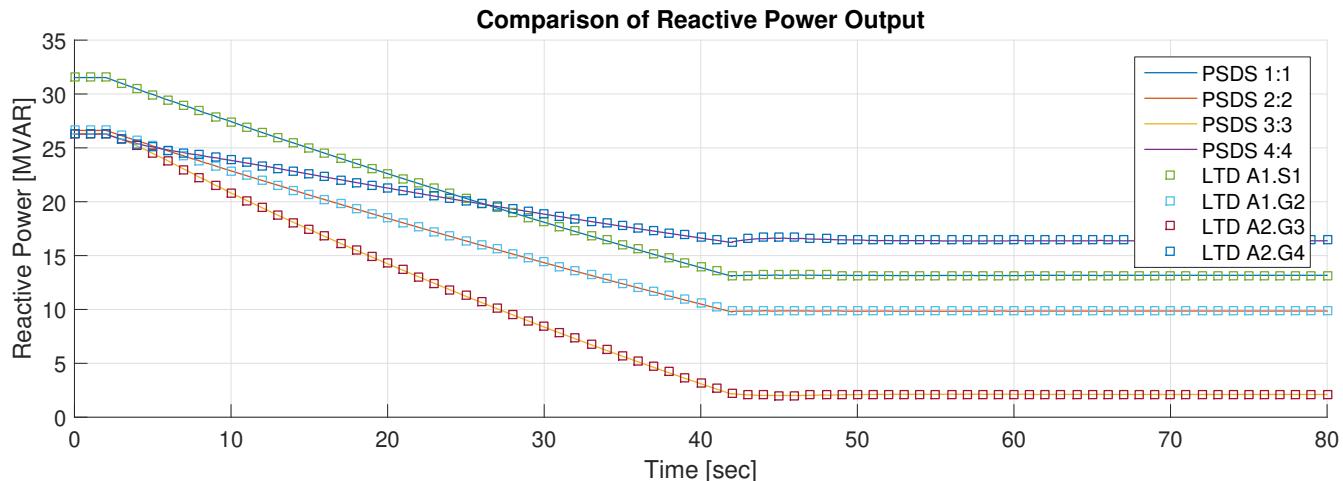


Figure 15: Reactive Power Output

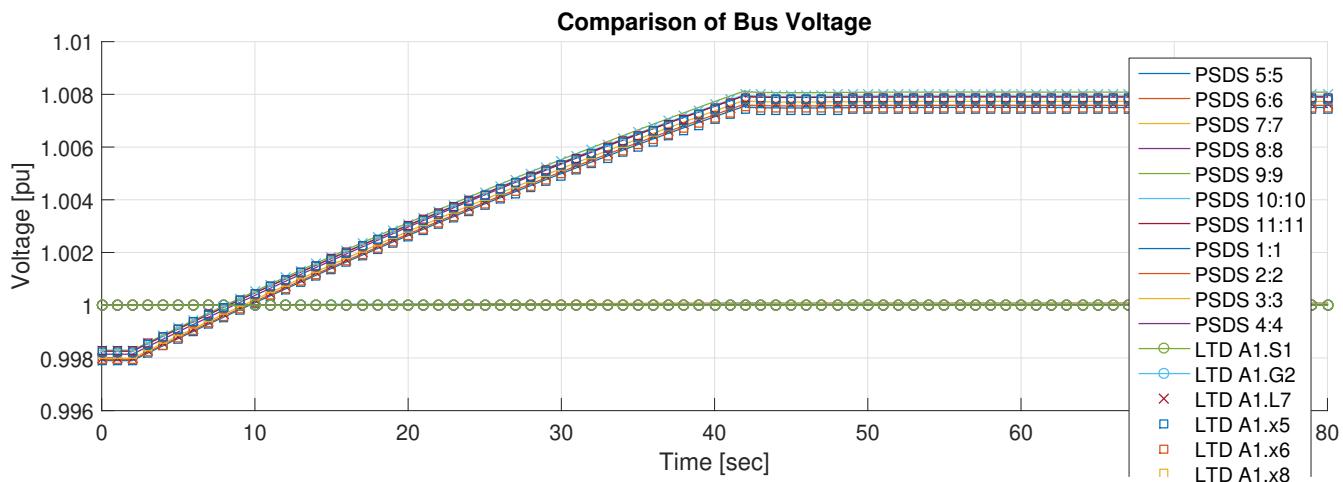


Figure 16: System Bus Voltages

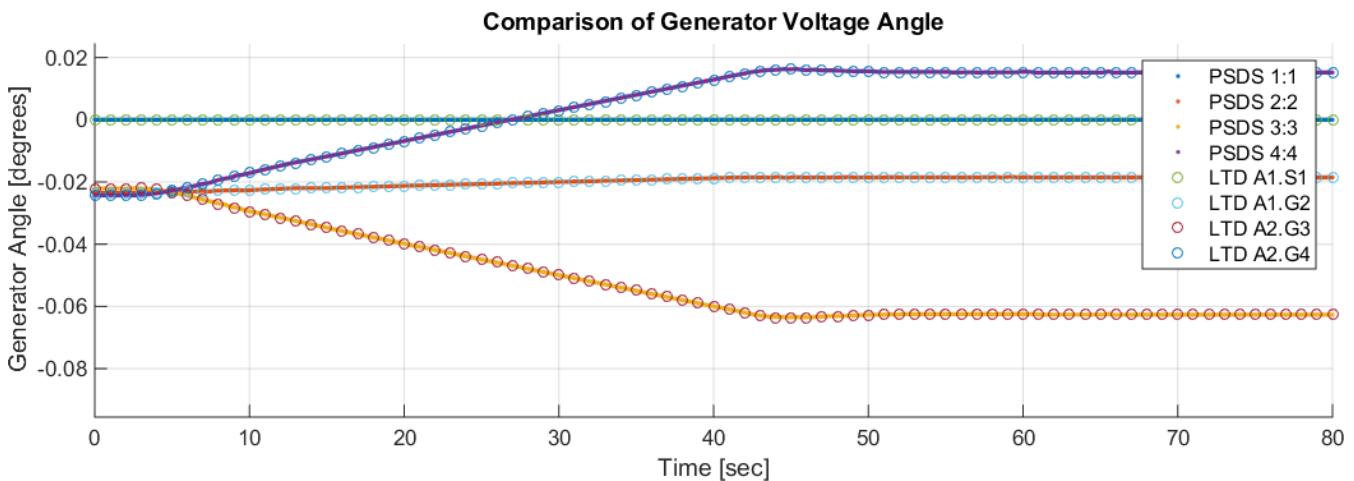


Figure 17: Generator Angles