Recent Progress:

1. Rework tgov1 model to account for `Pref` completed.
2. MiniWECC step test results re-validated using different time steps.
3. Code flowchart being compiled to aid in further development (timing).
4. GitHub updated: `https://github.com/thadhaines/PSLTDSim/`

Current Tasks:

1. Work to incorporate Matt's *Suggested Use Cases* into simulation.
2. Add logging to Shunt and Branch Agents
3. Add perturbance Agents for Generator/Slack, Shunt, Branch, …
4. Define Agent actions for AGC/LFC (i.e. ACE calculations)
5. Think about Shunt Control / Generic Agent control based on system state(s)
6. Formulate feasible plan of action for casting all WECC governors to LTD governors (tgov1). Something like:
   (a) Parse models of interest from dyd.
   (b) Automate one machine infinite bus test in PSDS.
   (c) Generate/Calculate LTD equivalent model parameters from results
   (d) Export custom dyd for LTD simulation. (PSDS would still use original the dyd, though *could* use modified dyd)

Future Tasks: (Little to No Progress since last time / Things coming down the pipe)

1. Formulate an experiment utilizing a multi-area model that can be validated with PSDS.
2. Identify System Slack bus programmatically (currently assumes first slack == global slack if > 1 slack found)
   AND/OR calculate system slack error differently → An average of slack errors?
3. Create an agent for every object: SVD, Transformer, …
4. Add import mirror / bypass mirror init sequence option. Will prevent repeated WECC mirror creations.
5. Matt request: Enable multiple dyd files to overwrite / replace previously defined agents/parameters
6. Matt request: Allow for variable time steps.

Current Questions:

1. Does $\Delta\omega = 1 - \omega$ in $\dot{\omega} = \frac{1}{2H_{sys}}\left(\frac{P_{acc}}{\omega} - D_{sys}\Delta\omega\right)$?
2. Overview of planned PSLF scenarios? → Similar to Heredia paper but on Wecc/MiniWecc Scale?
3. Is there more available/relevant event data that may help us to verify simulations of specific instances (wind ramps or other behavior) that novel research will focus on?
4. Any progress / continued interest in miniWecc Area definitions?

Goals:

1. Speed⟶ Order of Magnitude faster than PSDS (not met — only ≈3x faster)

7. Time step resolution: NOTE: Code changed after all previously listed test were ran. Changing the time step affects accuracy, size of data collected, and simulation run time. The following data was collected from a 90 second simulation. LTD uses rk45 integration and 0.5 MW slack tolerance — it is also run from the command line.The PSDS system has exciters and PSS included in dyd file. Theoretical steady state frequency was calculated as
$f = 1 + \Delta f = 1 + \frac{\Delta P}{S_{base}\beta} = 1 + \frac{-1200MW}{100 \times 15{,}555} = 0.999228543876567 = 59.953712632594019Hz$

	Time step	Simulation Time [sec]	Data File Size [KB]	Real time Speed up	PSDS Speed up	Reduction of file size	Steady State f error [Hz]
PSDS	4.167 ms	56.12	35,070.00	1.60	1.00	1.00	0.0034
LTD	2 sec	9.41	300.00	9.56	5.96	116.90	0.0017
LTD	1 sec	17.39	496.00	5.18	3.23	70.71	0.0017
LTD	0.5 sec	33.05	888.00	2.72	1.70	39.49	0.0017
LTD	0.25 sec	63.67	1,672.00	1.41	0.88	20.97	0.0017

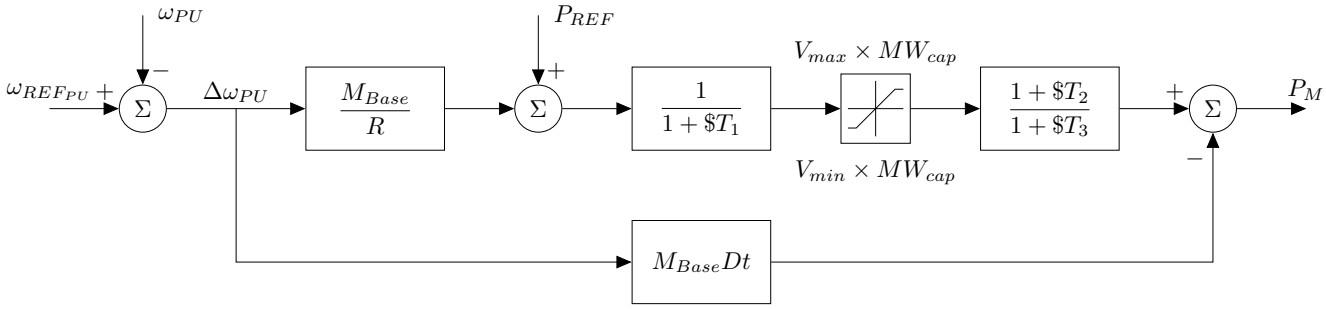

Figure 1: Updated tgov1 model.

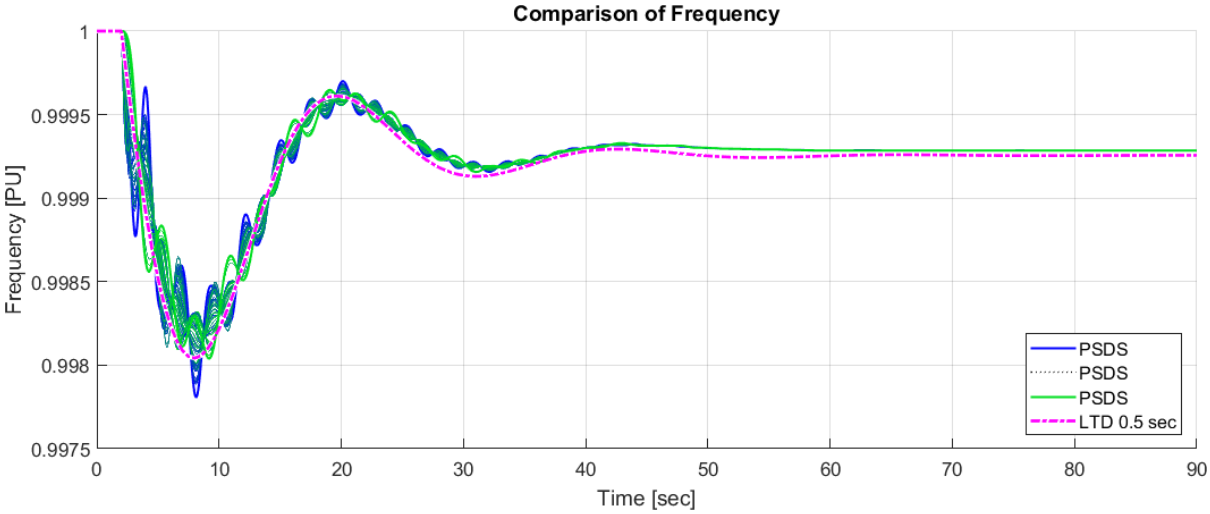

Figure 2: Frequency response to a 1,200 MW load step.

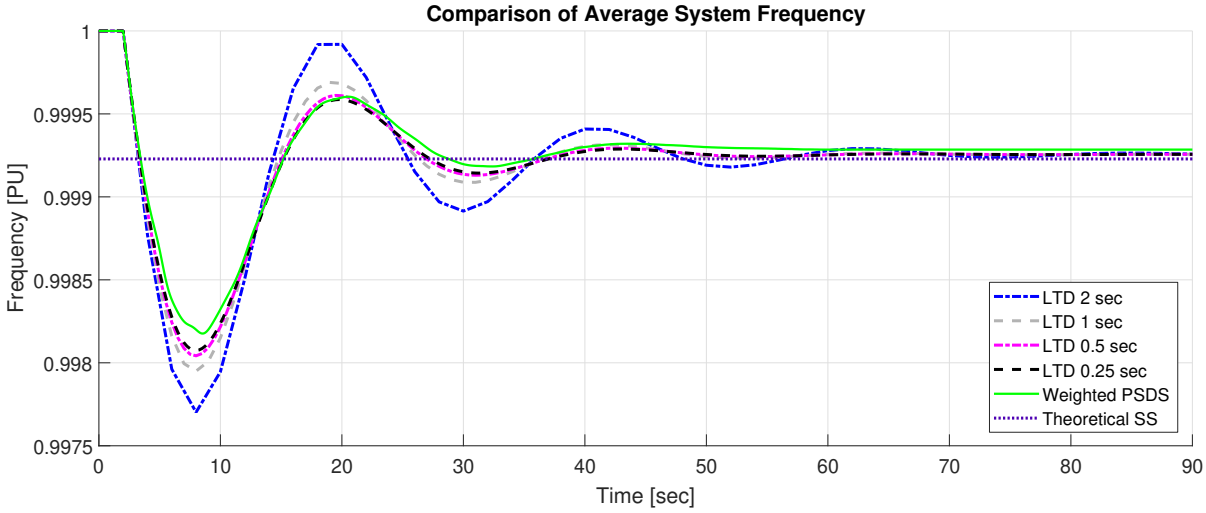

Figure 3: Average frequency of different time steps during a 1,200 MW load step.

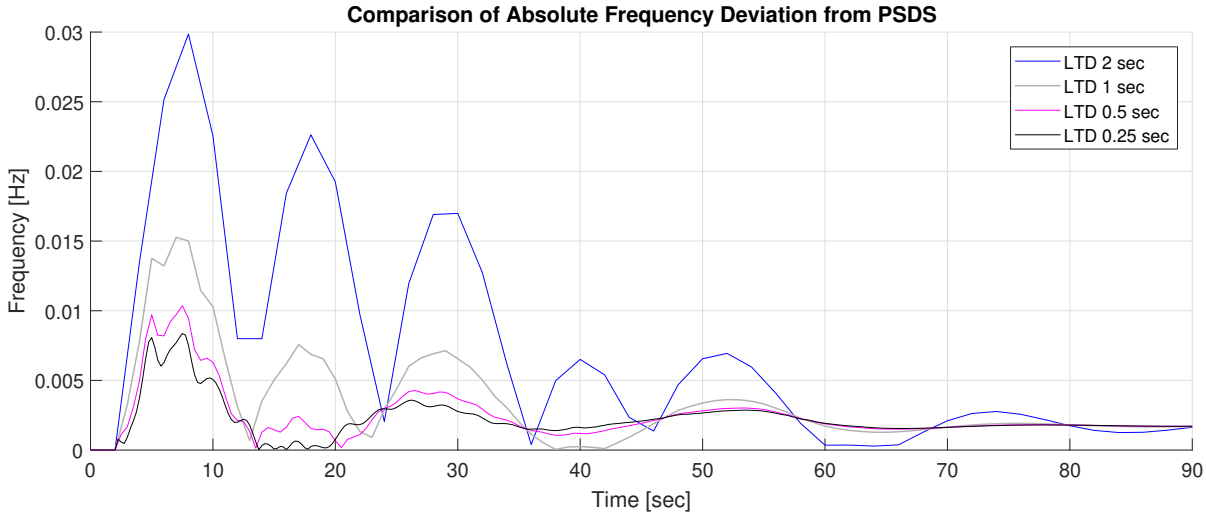

Figure 4: Relative Hz difference of PSDS - LTD (i.e. $\left|f_{PSDS}(t) - f_{LTD}(t)\right| \times 60\text{Hz}$).