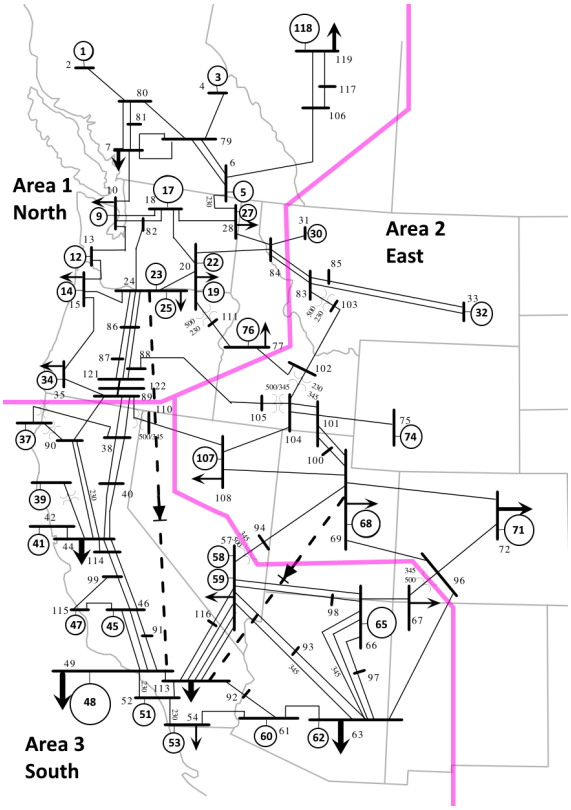
10 Minute AGC Recovery of Mini WECC after 435 MW Load Step

- Mini WECC system:
  - Buses: 122
  - Lines: 171
  - Loads: 88
  - Machines: 34
  - States: 623
- Event: +435 MW load step on Bus 2 in Area 1 at t=1.
- Each area has identical conditional AGC that acts at t=40 and again when t=160, 280, 400, 520 (i.e. 2 minute action time).
- ODE solver tolerances:

  Relative: 1e-5

  Absolute: 1e-7



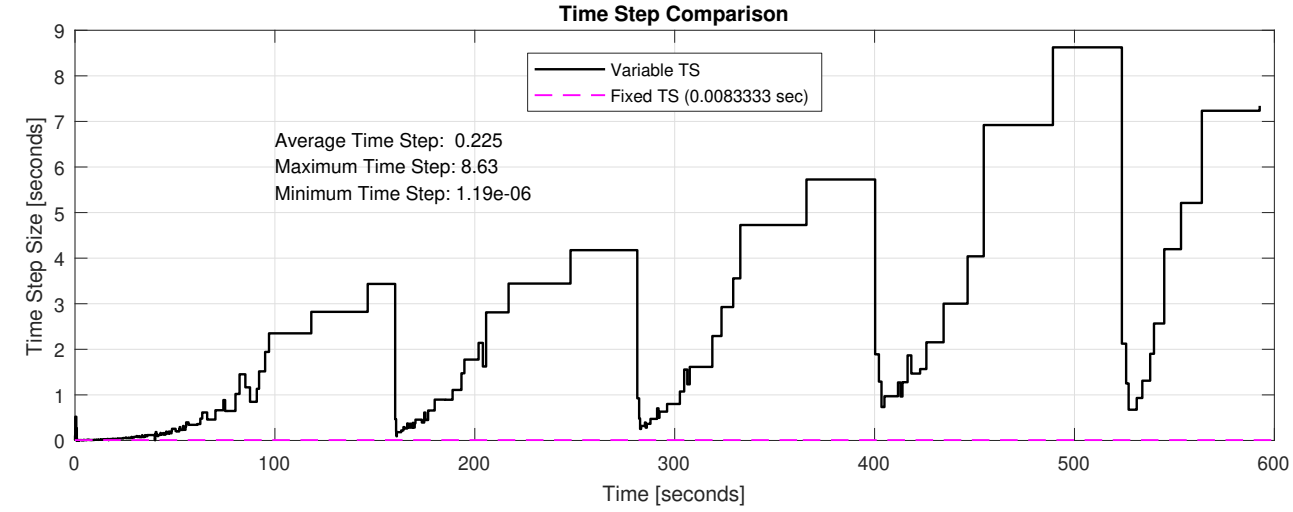
Result Summary:

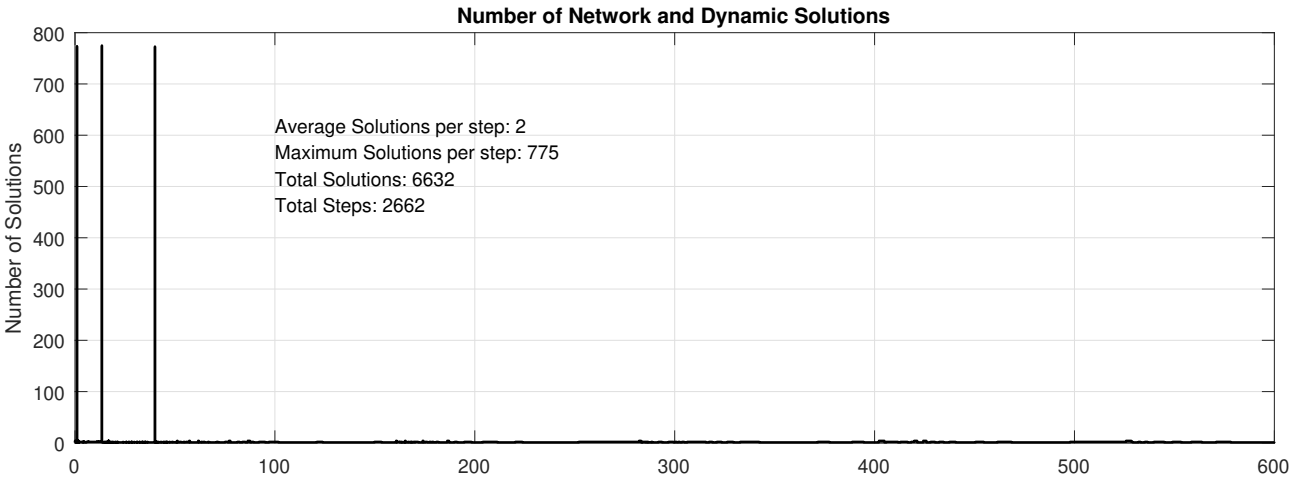
- Using the ode23/ode23t methods provided a 9 times speed up over Huen's 'fixed step' method.
- 27 times fewer steps were taken using VTS which resulted with a saved file size that was approximately 24 times smaller than the Huen's method data file.
- VTS methods appeared to capture fast dynamics well.
- VTS and fixed time step results may 'drift' slightly when time steps become large. Effect can be reduced via ODE solver tolerance settings or additional `sw_con` time blocks.

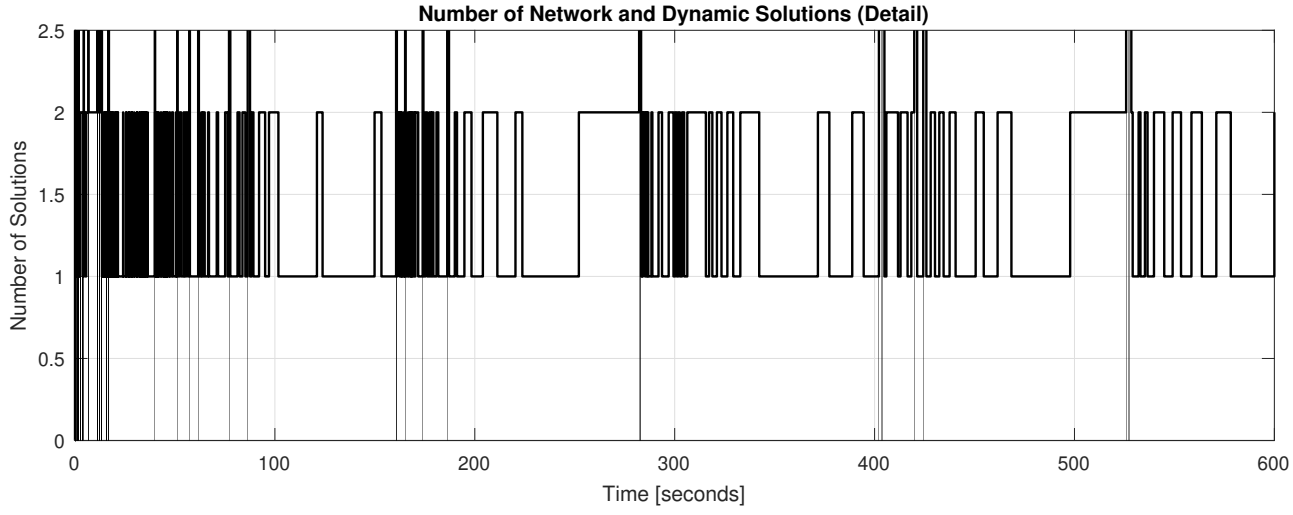
	Step Size [seconds]				Solutions Per Step				
Method	Max	Min	Ave	Total Steps	Ave	Max	Total Slns.	Sim. Time [seconds]	File Size [bytes]
Huen's	0.0083	8.33E-03	0.0083	72,001	2	2	144,002	483.64	778,259,381
ode23/ ode23t	8.6300	1.19E-06	0.0570	2,662	2	775	6,632	53.4	32,772,591
ΔRatio	0.001	7,000	0.146	27.05	1	0.003	21.71	9.06	23.75

Step Size and Solution Count Data

Time blocks from: [0:1], [1:40], and [40:600]. Many solutions are executed at beginning of time blocks due to ODE solver method *possibly* creating a Jacobian.

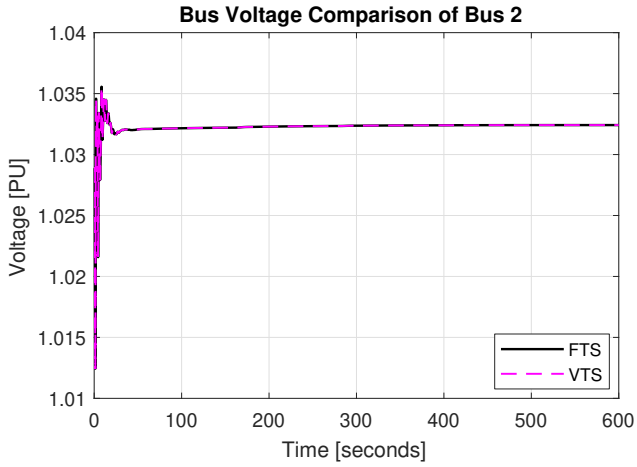


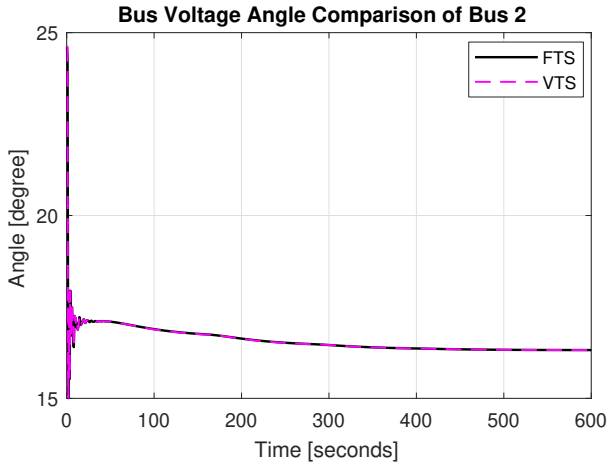


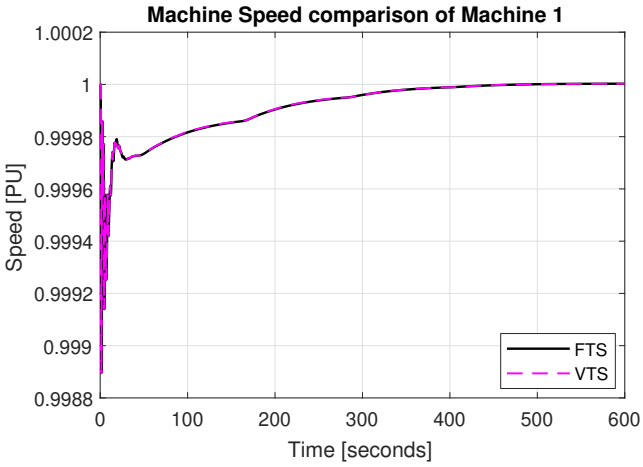


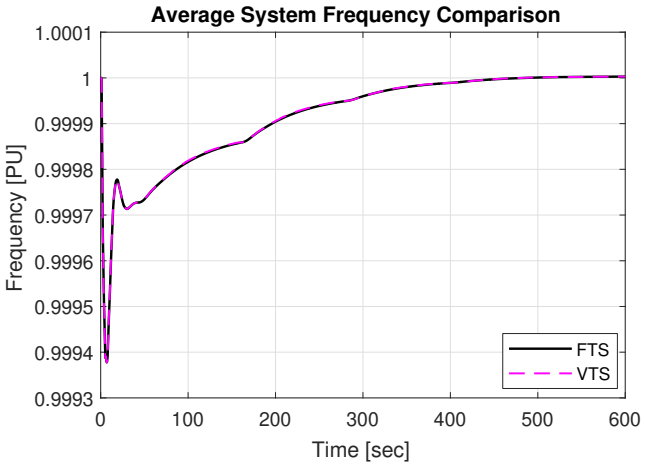
Select Comparisons: t = 0:600 (full simulation)

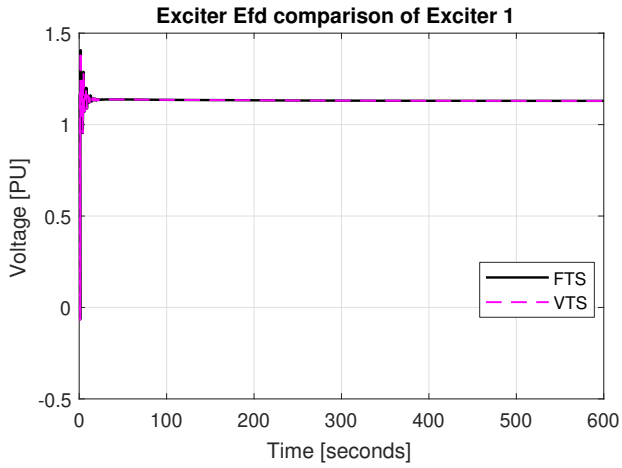
Simulation has a lot of time where not many fast dynamic changes are taking place.

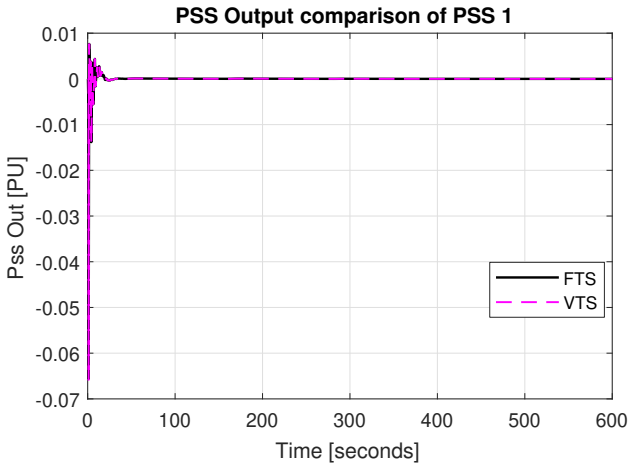






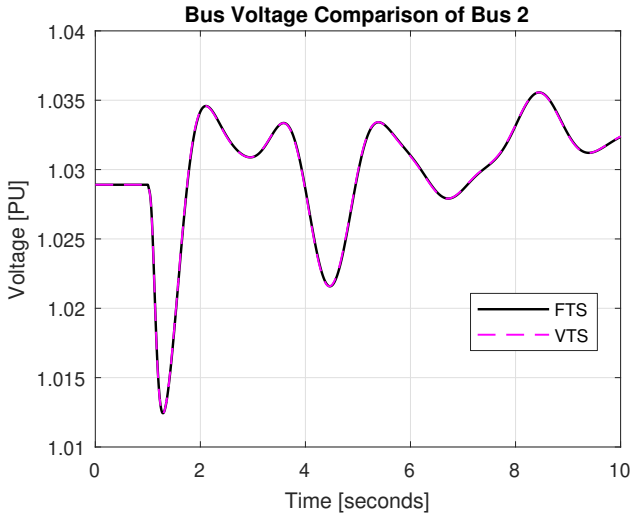


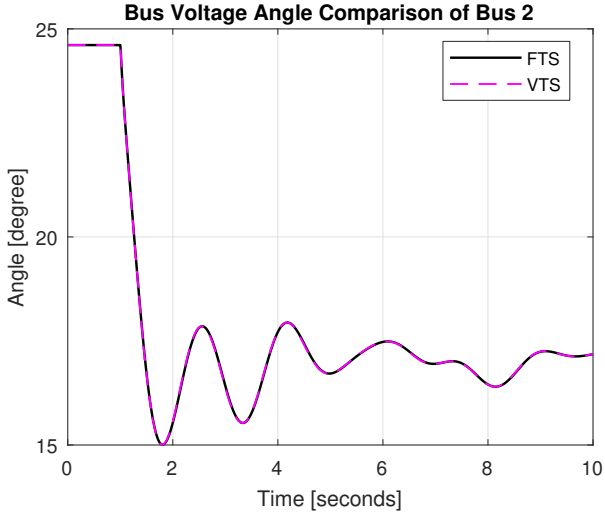


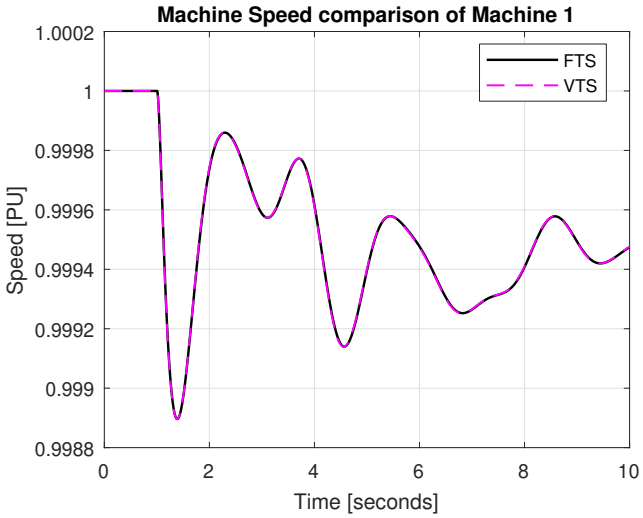


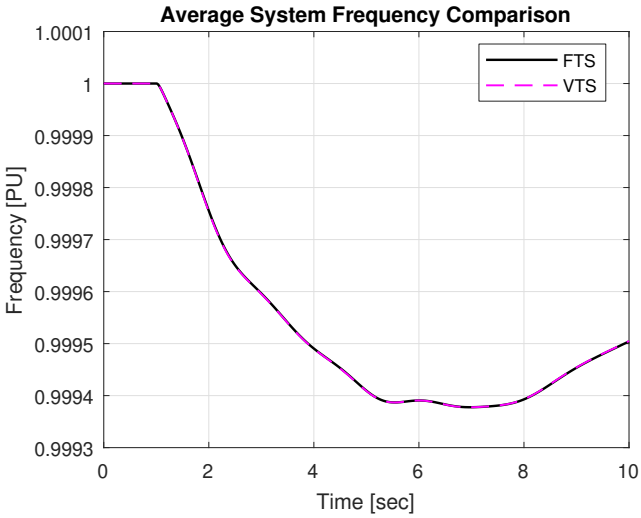
Select Comparisons: t = 0:10

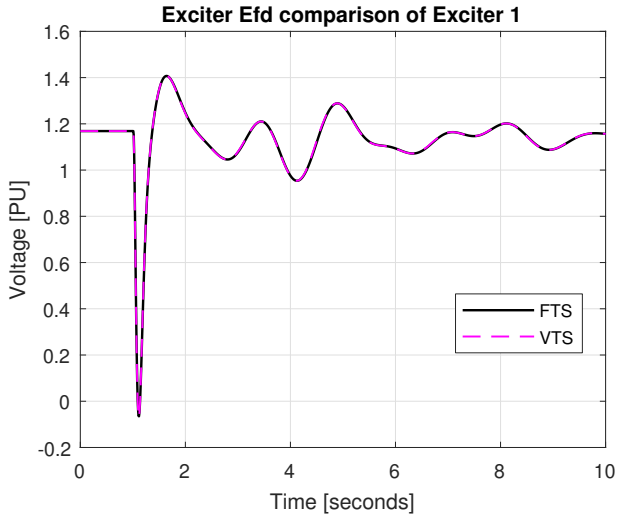
Initial transients are captured well.

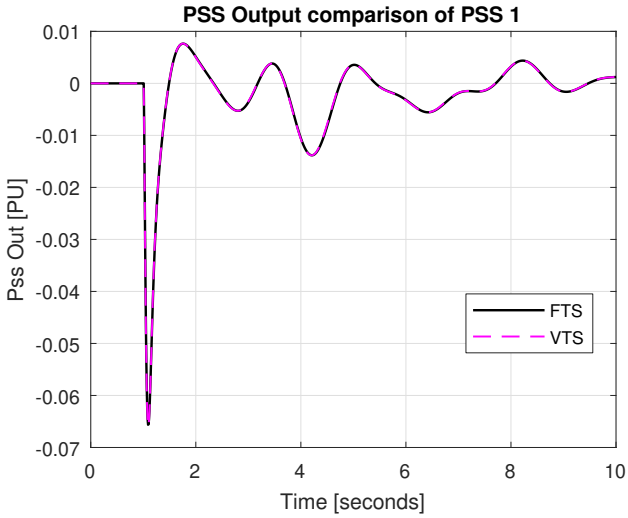






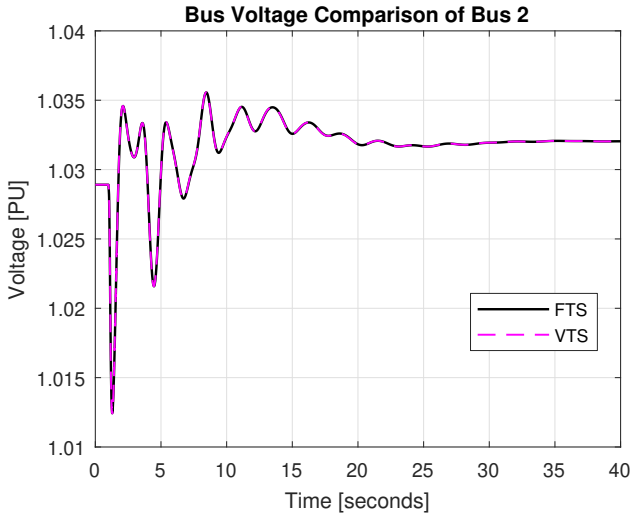


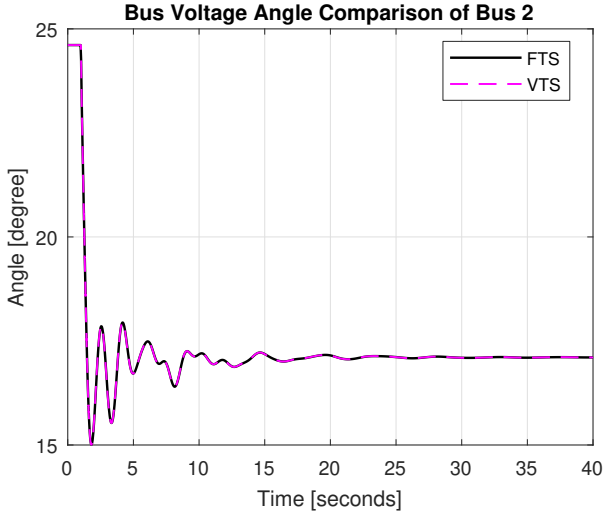


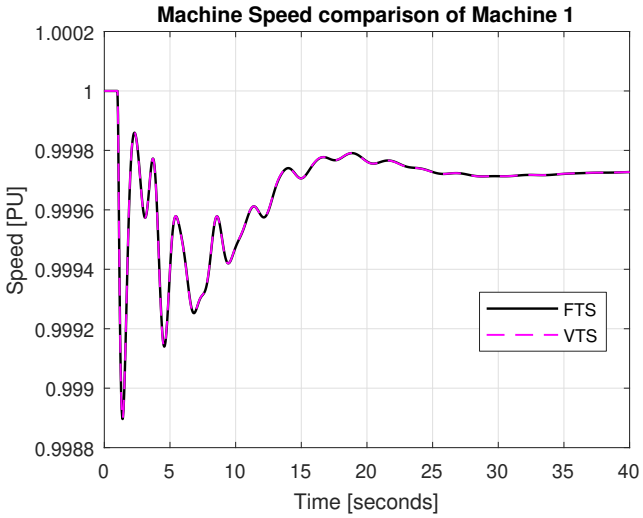


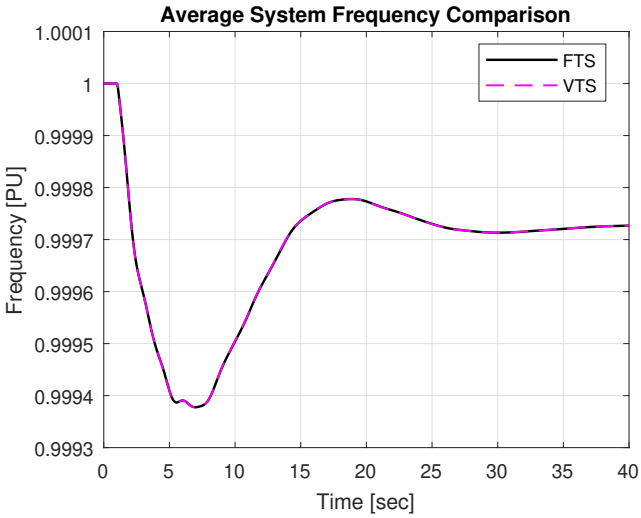
Select Comparisons: t = 0:40

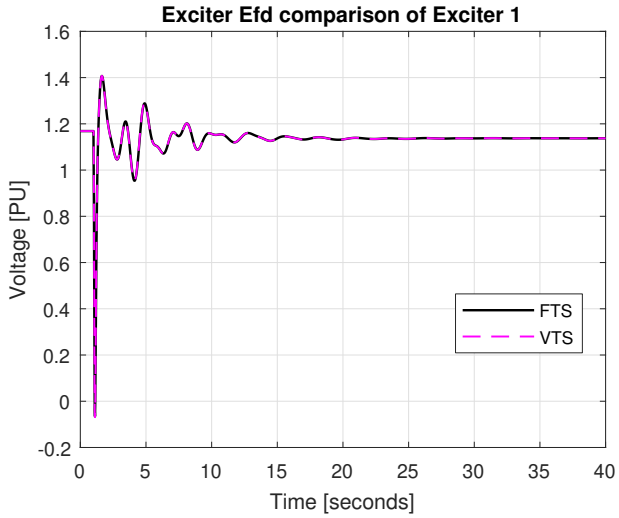
Simulation methods continue to match while system stabilizes.

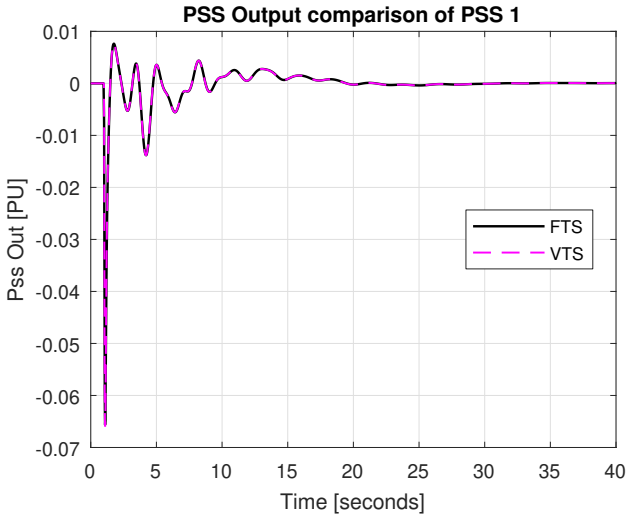












Select Comparisons: t = 260:360 (Result 'Drift' - Scale should be noted)

As individual time blocks were not created for each AGC action, dispatches may not be synchronized between simulations and add to state drift.