Long-Term Power System Dynamic Simulation using Time Sequenced Power Flows

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Montana Tech - Master's Thesis Research Project

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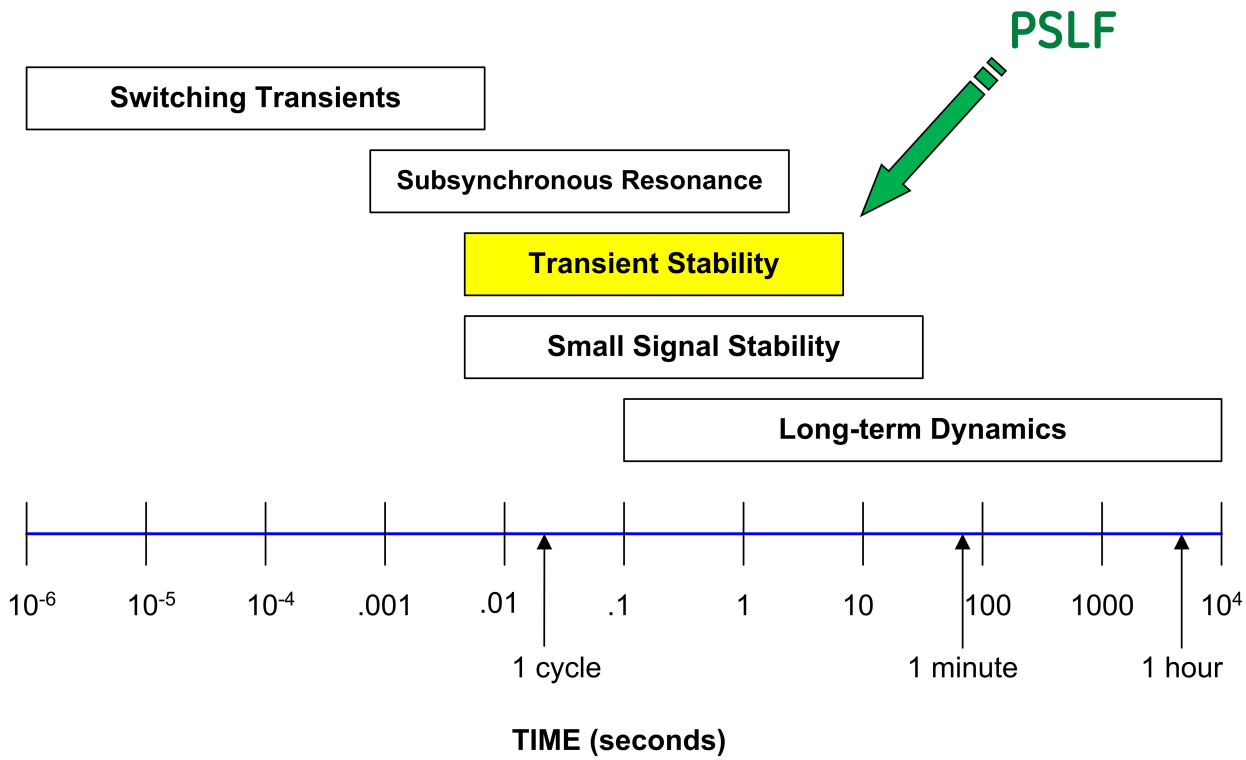
What are long-term dynamics (LTD)? [1]



This simulation assumes:

1. Time steps of 0.5 to 1 second.
2. Fast dynamics are 'mostly' ignored.
3. System remains stable.
4. System frequency is described by the combined PU swing equation:

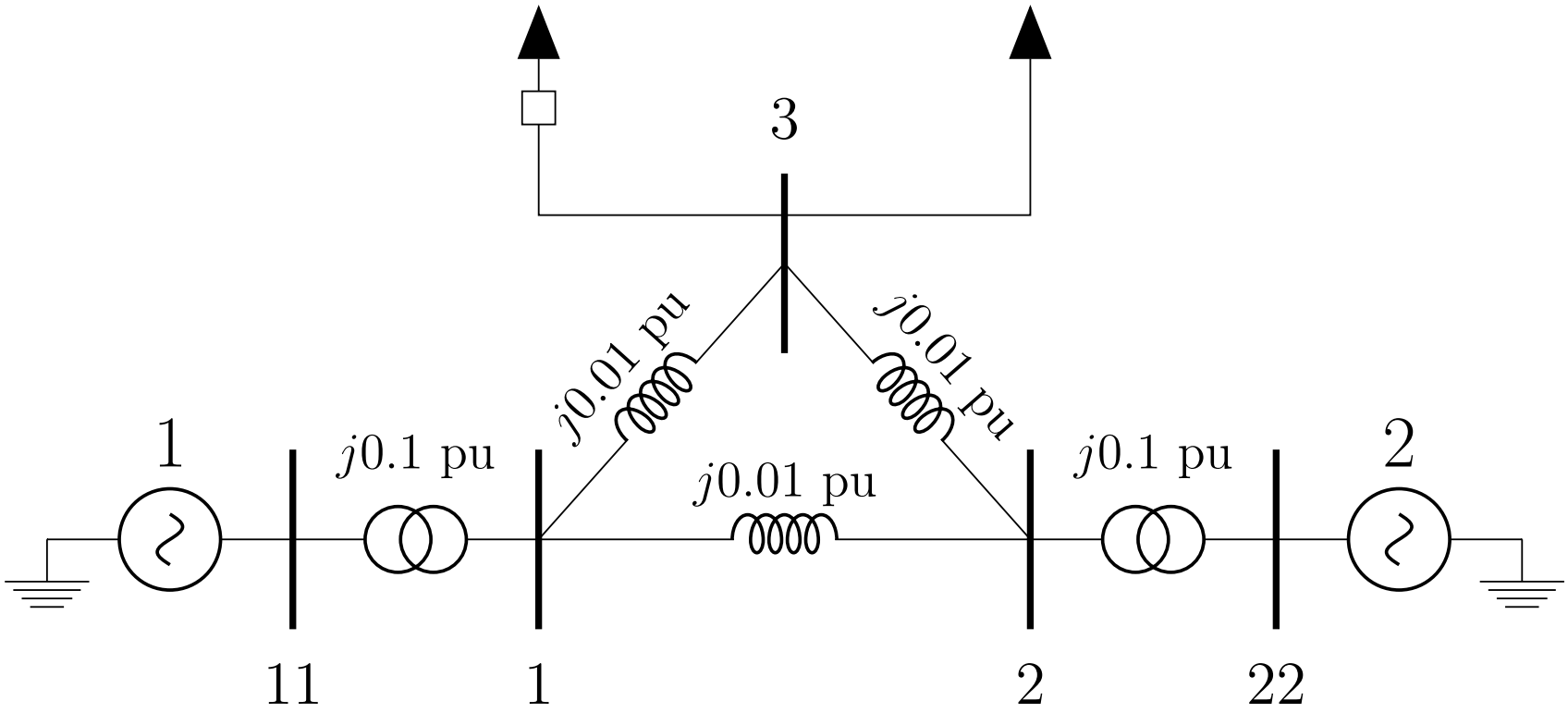
$$\dot{\omega}_{sys} = \frac{1}{2H_{sys}} \left(\frac{P_{acc,sys}}{\omega_{sys}(t)} - D_{sys} \Delta\omega_{sys}(t) \right)$$

5. No system damping $(D_{sys} = 0)$.

Project Goals:

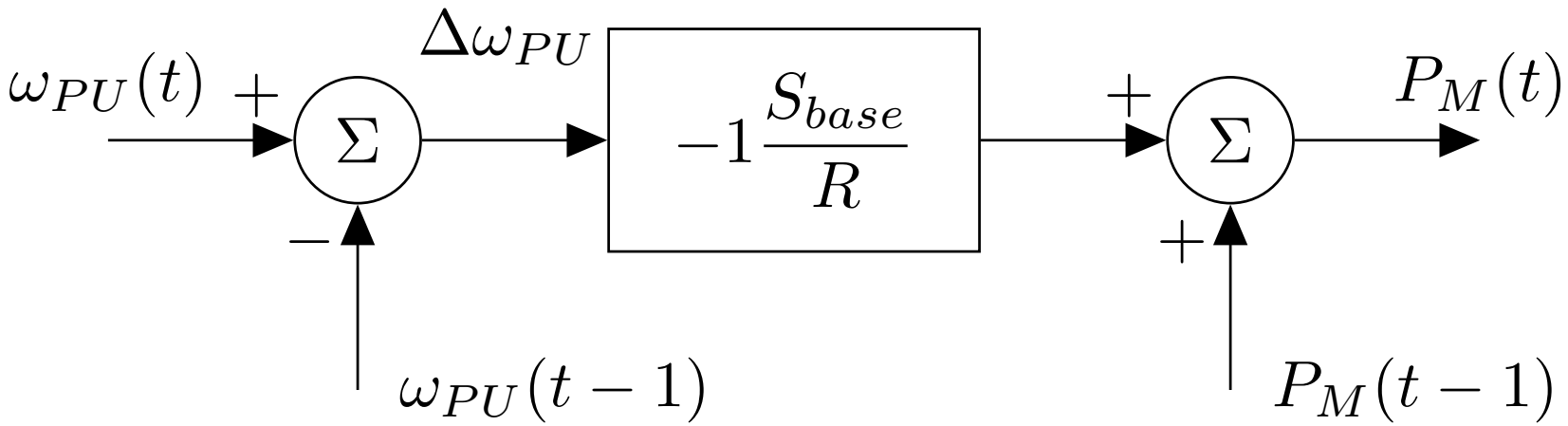
- Develop computer software for LTD simulations using PSLF systems $(.sav)$, dynamic data $(.dyd)$, and customized dynamic models.
- Use software to investigate system reactions that may be impractical to simulate using other approaches.
- Write a master's thesis about it.

PSLF test system:



Generators are identical genrou models.
Gen 1 has a tgov1 governor.

pgov1 : Proportional gain control of P_M



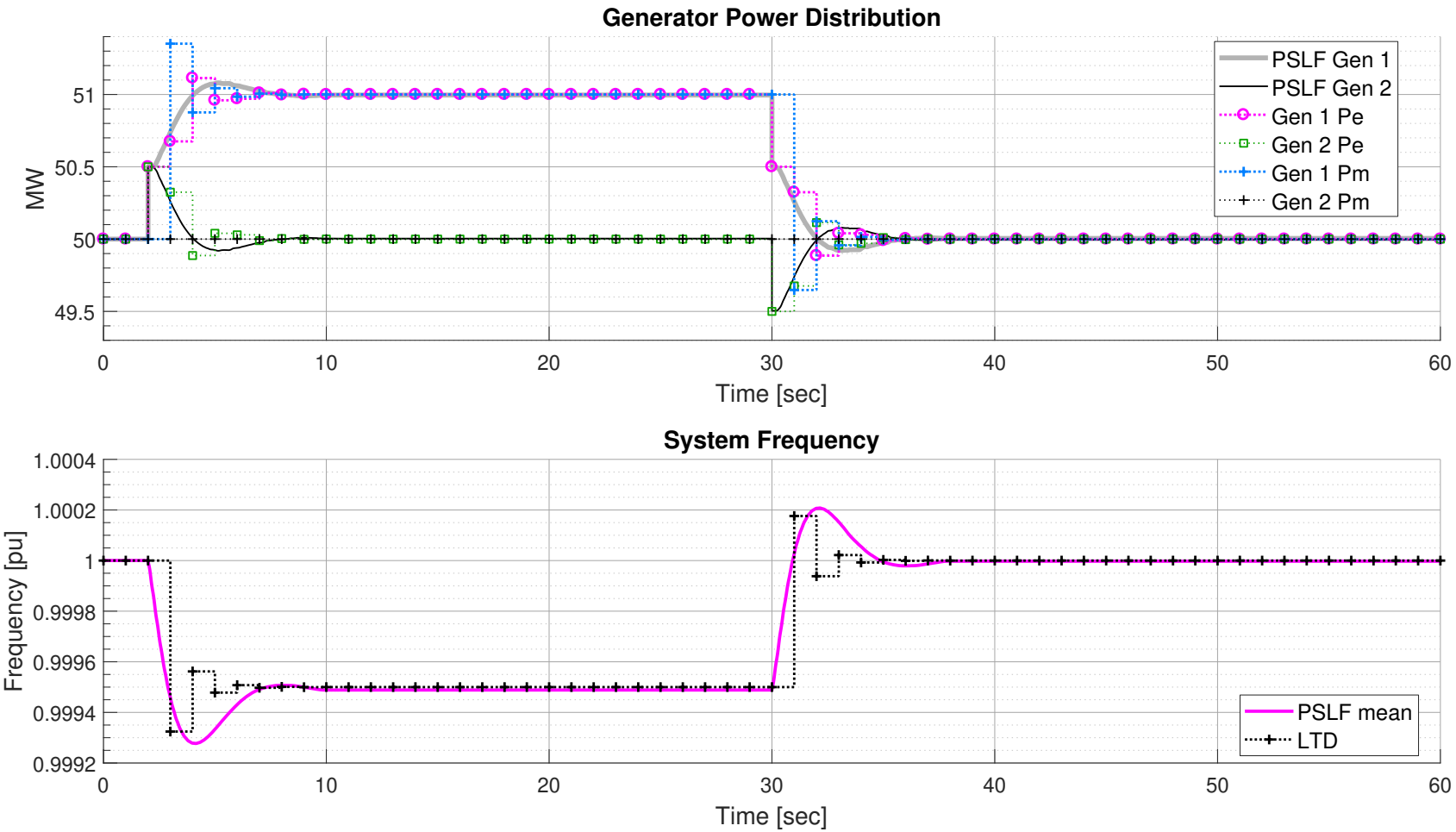
Entered into system via parsed text file:

```
# model   busnum busnam basekv id  : #9 mwcap droop
#!pgov1    11 "11" 22.00 "1 " : #9 mwcap=100.0  0.05
```

Model adapted from [3]

Dynamic model 'pgov1' experiment: +1 MW t=2, -1 MW t=30

pgov1 on Gen 1, t_{step} =1.0 second



Dynamic model 'pgov1' experiment: +1 MW t=2, -1 MW t=30

pgov1 on Gen 1, t_{step} =0.5 second