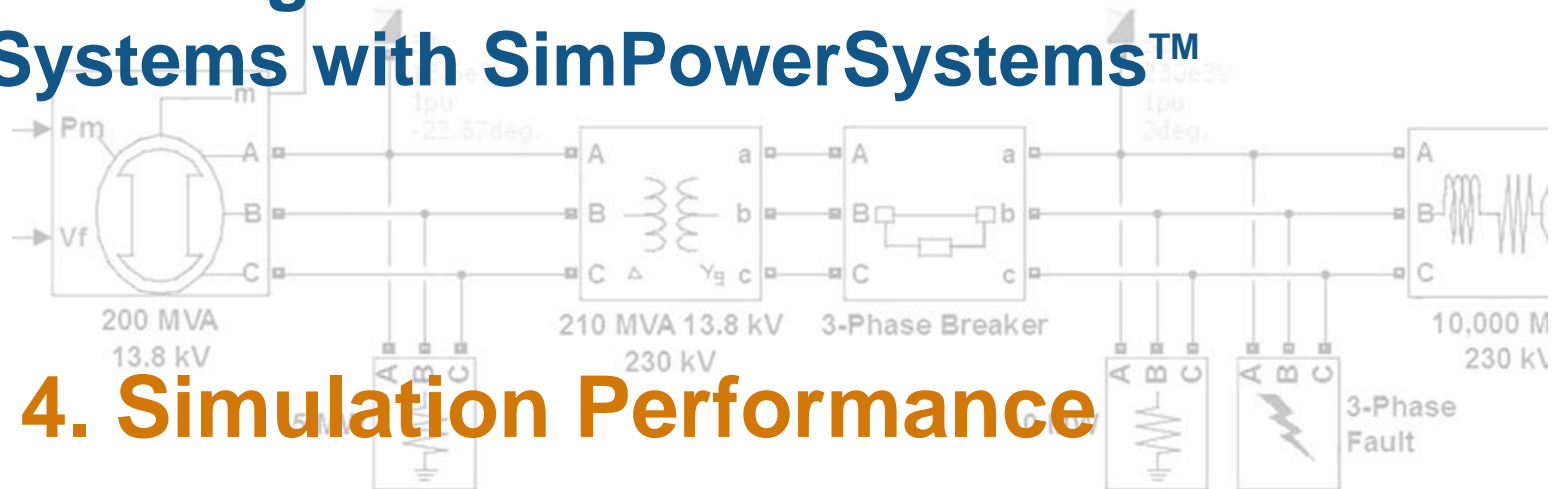


SimPowerSystems Hands-on Workshop: Modeling and Simulation of Electrical Power Systems with SimPowerSystems™



4. Simulation Performance



Carlos Osorio

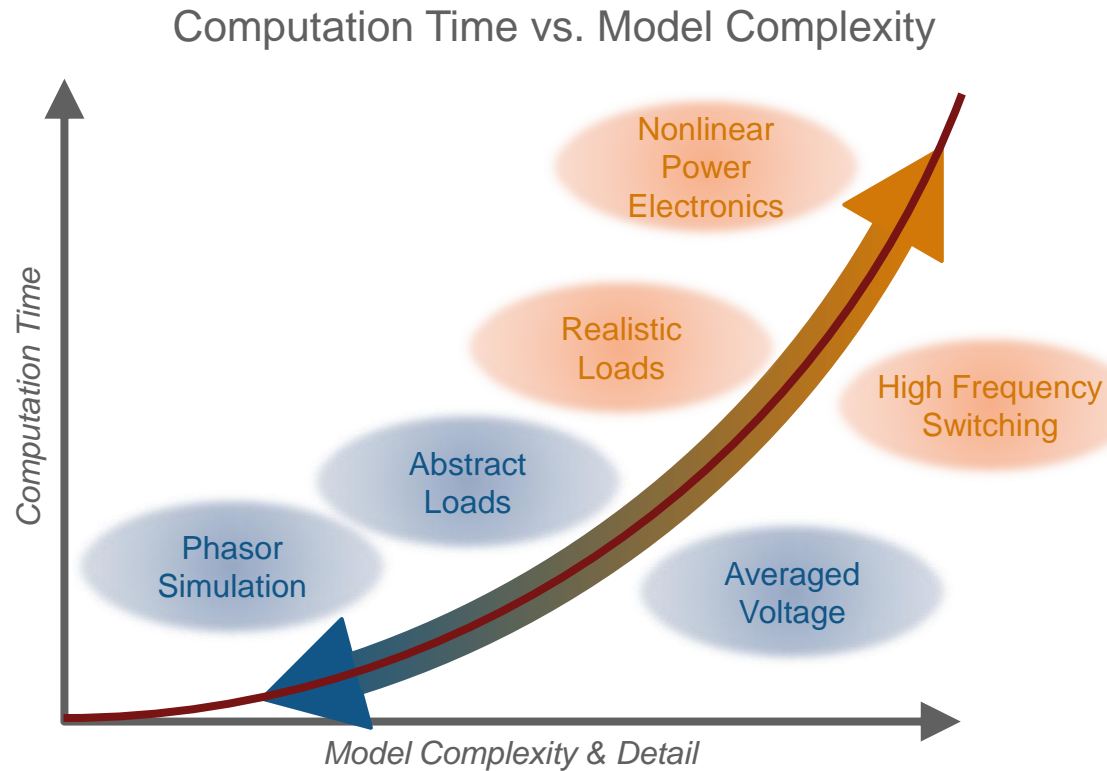
Principal Application Engineer

MathWorks – Natick, MA

Outline

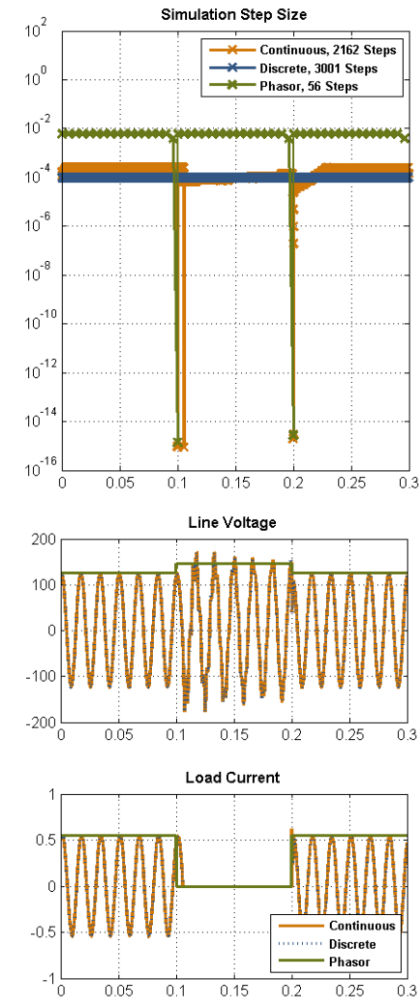
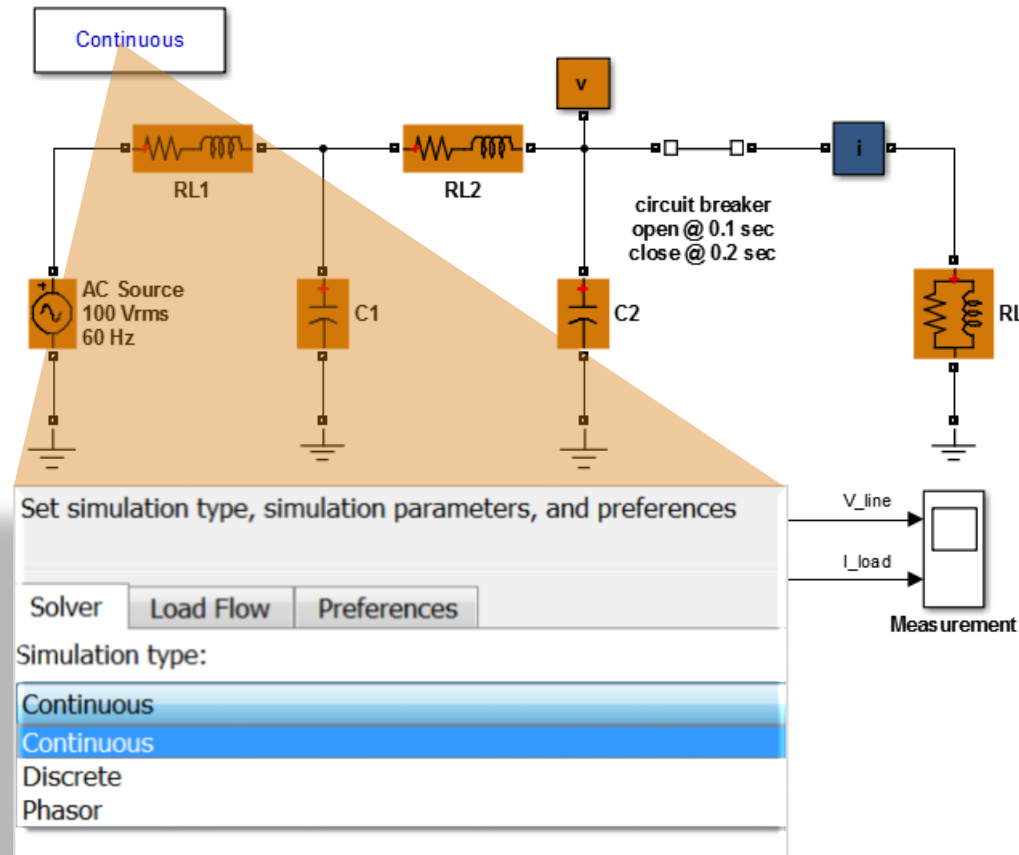
- Model fidelity vs. simulation speed
- SimPowerSystems simulation modes
 - Inter-machine oscillation example
 - Matrix converter example
 - Power inverter example

Model fidelity vs. simulation speed



Configure your model to balance the trade-off between simulation speed and model fidelity based on the goals of your simulation

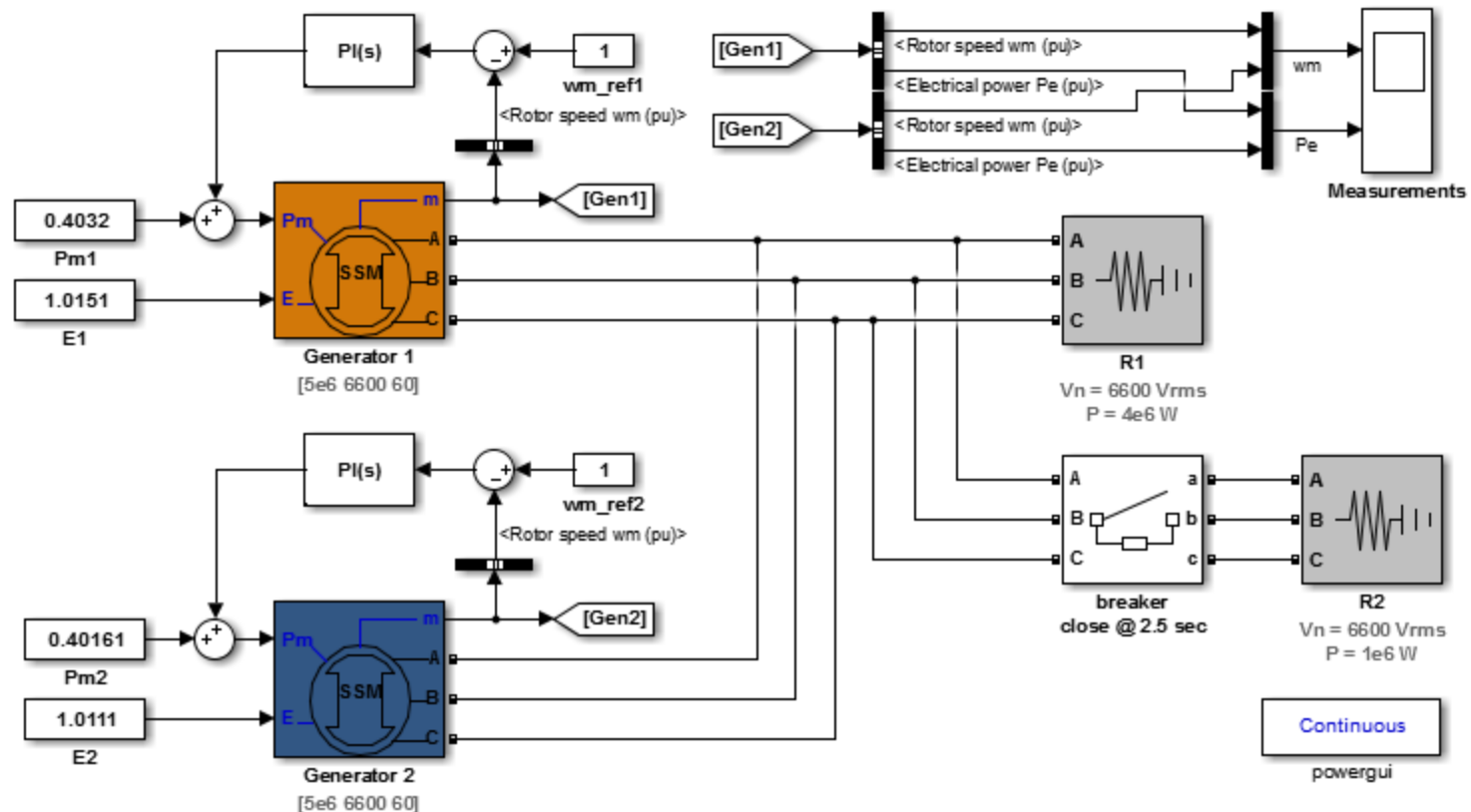
SimPowerSystems simulation modes



```
>> edit compare_simulation_modes
```

SimPowerSystems simulation modes

Inter-machine oscillation example

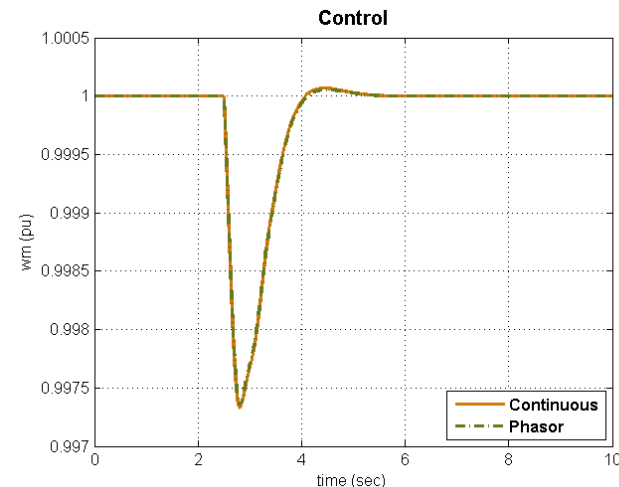
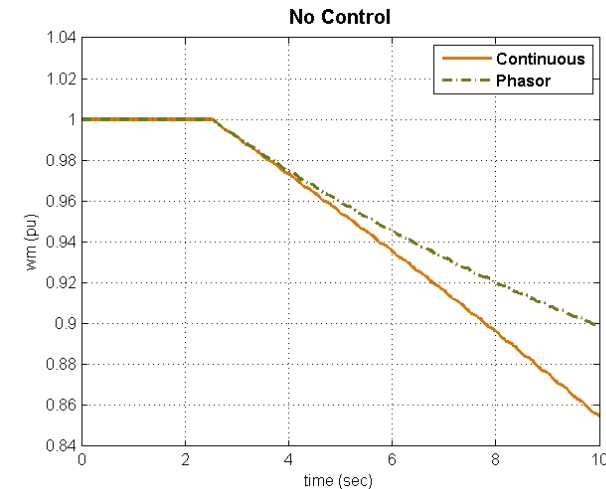


```
>> inter_machine_oscillation
```

SimPowerSystems simulation modes

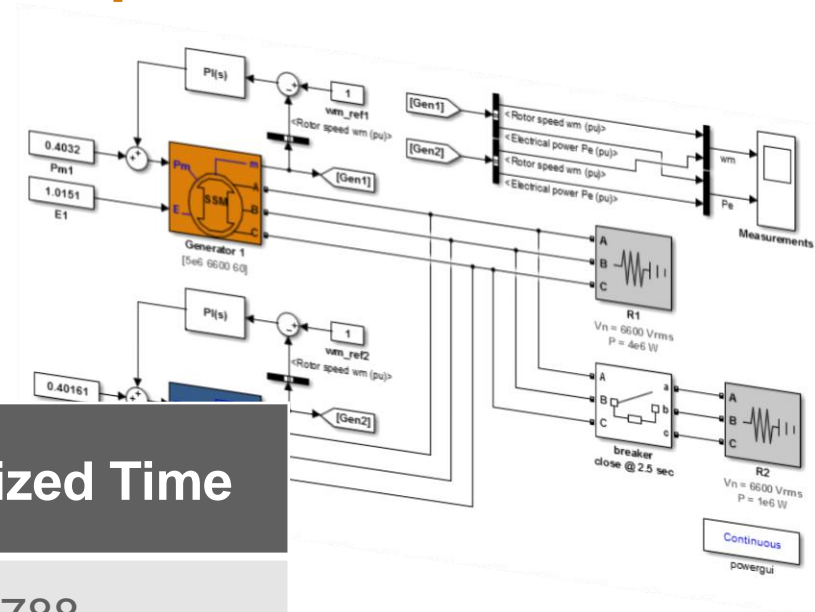
Inter-machine oscillation example

- When there is **no active control**, the frequency will drop when the load **R2** is connected
- This will result in the phasor model results becoming increasingly inaccurate the further the frequency moves away from nominal
- If **active control*** is in place, then the phasor simulation method is very effective for fast, credible results (*Note: in this example voltage regulators were excluded for clarity)



SimPowerSystems simulation modes

Inter-machine oscillation example

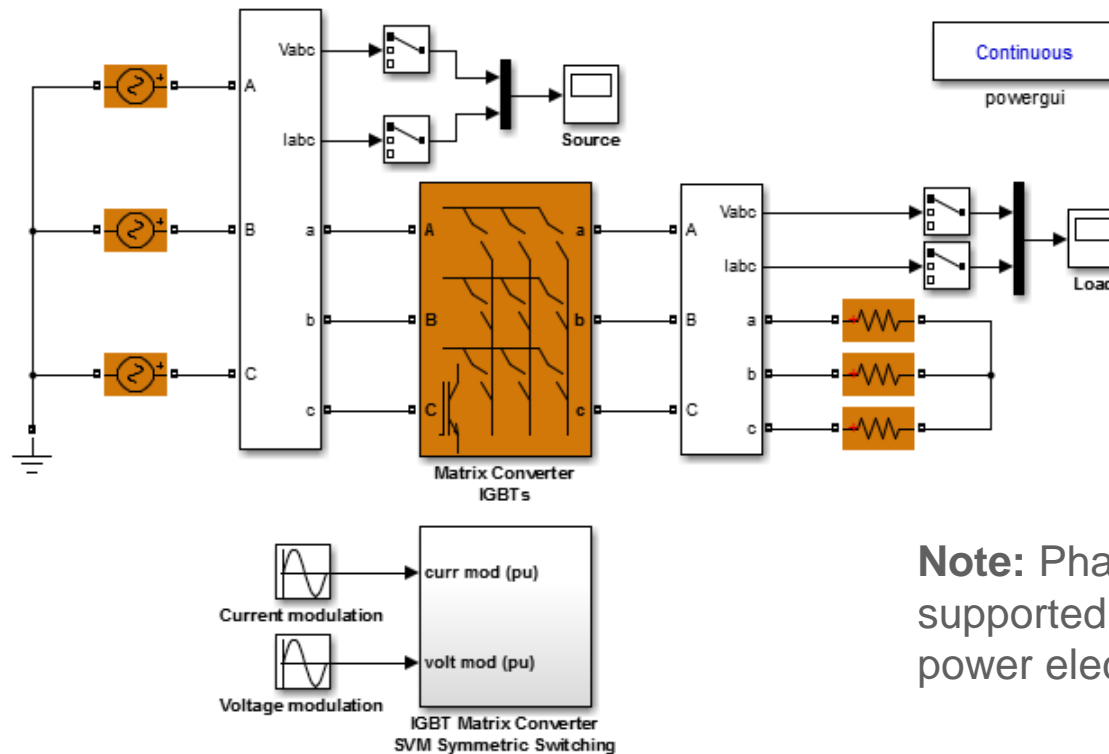


Simulation Mode	Normalized Time
Continuous	0.788
Discrete $T_s = 1e-04$	1
Phasor	0.034

```
>> edit bench_inter_machine_oscillation
```

SimPowerSystems simulation modes

Matrix converter example



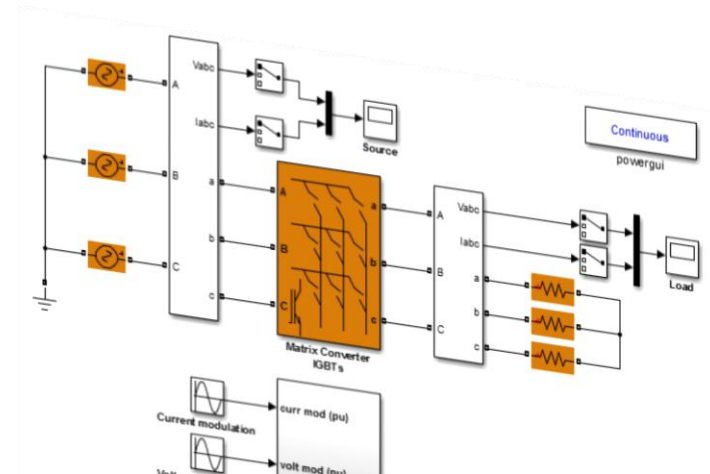
Note: Phasor mode is not supported for systems with power electronic devices

Three-Phase Matrix Converter

```
>> threephase_matrix_converter
```


SimPowerSystems simulation modes

Matrix converter example

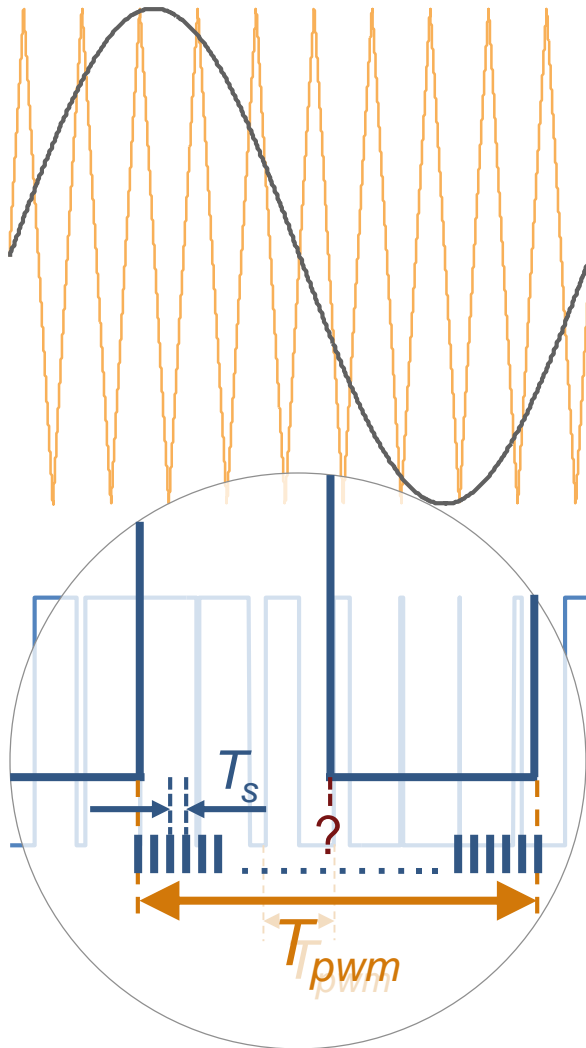


Simulation Mode	Normalized Time (Normal Mode)	Normalized Time (Accelerator Mode)
Continuous	1	0.220
Discrete $T_s = 2.5e-06$	0.128	0.024

```
>> edit bench_threephase_matrix_converter
```

SimPowerSystems simulation modes

Discrete mode - Selecting the integration step size



circuit dynamics

↓ x 10...20

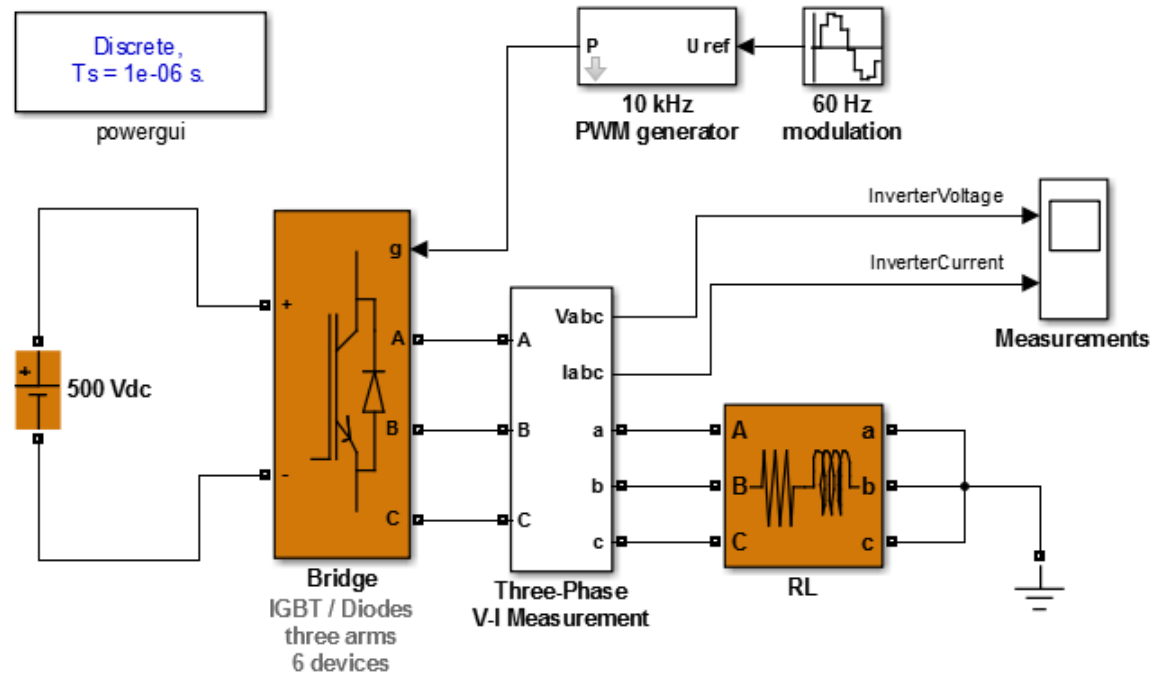
switching frequency (f_{pwm})

↓ x 100...500

duty cycle resolution (f_s)

SimPowerSystems simulation modes

Power inverter example

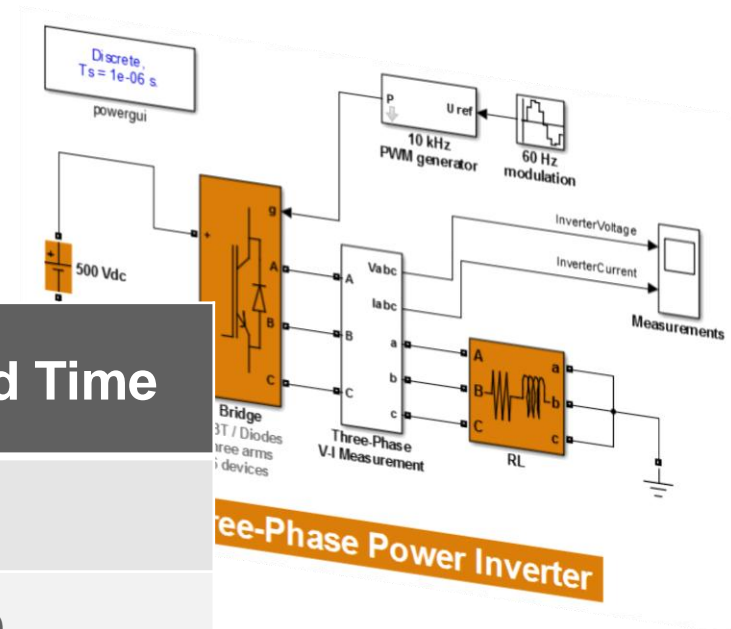


Three-Phase Power Inverter

```
>> threephase_power_inverter
```

SimPowerSystems simulation modes

Power inverter example



Simulation Mode	Normalized Time
Continuous	1
Continuous Ideal Switches	0.279
Discrete $T_s = 1e-06$, Normal Mode	0.285
Discrete $T_s = 1e-06$, Accelerator Mode	0.071

```
>> edit bench_threephase_power_inverter
```

