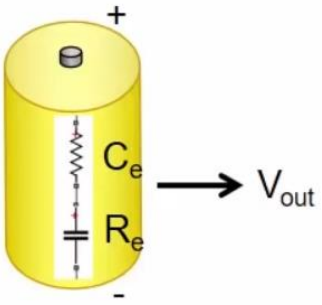
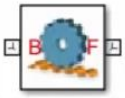
Physical Modeling Tutorial

Part1: Introduction to Simscape

Outline

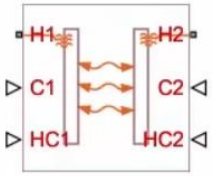
- Introduction to Simscape
- Modeling differences between Simulink and Simscape
- Building and simulating a model in Simscape
- Guidelines for Simscape modeling





Rack and Pinion Constraint

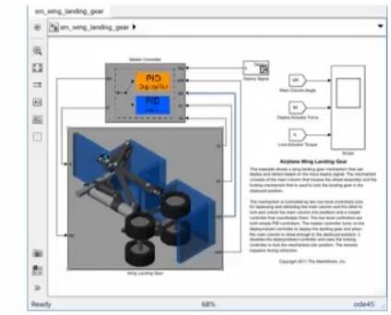
Double-Acting Hydraulic Cylinder

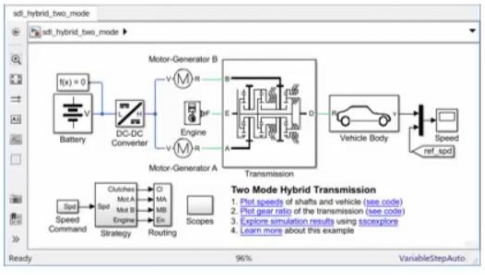


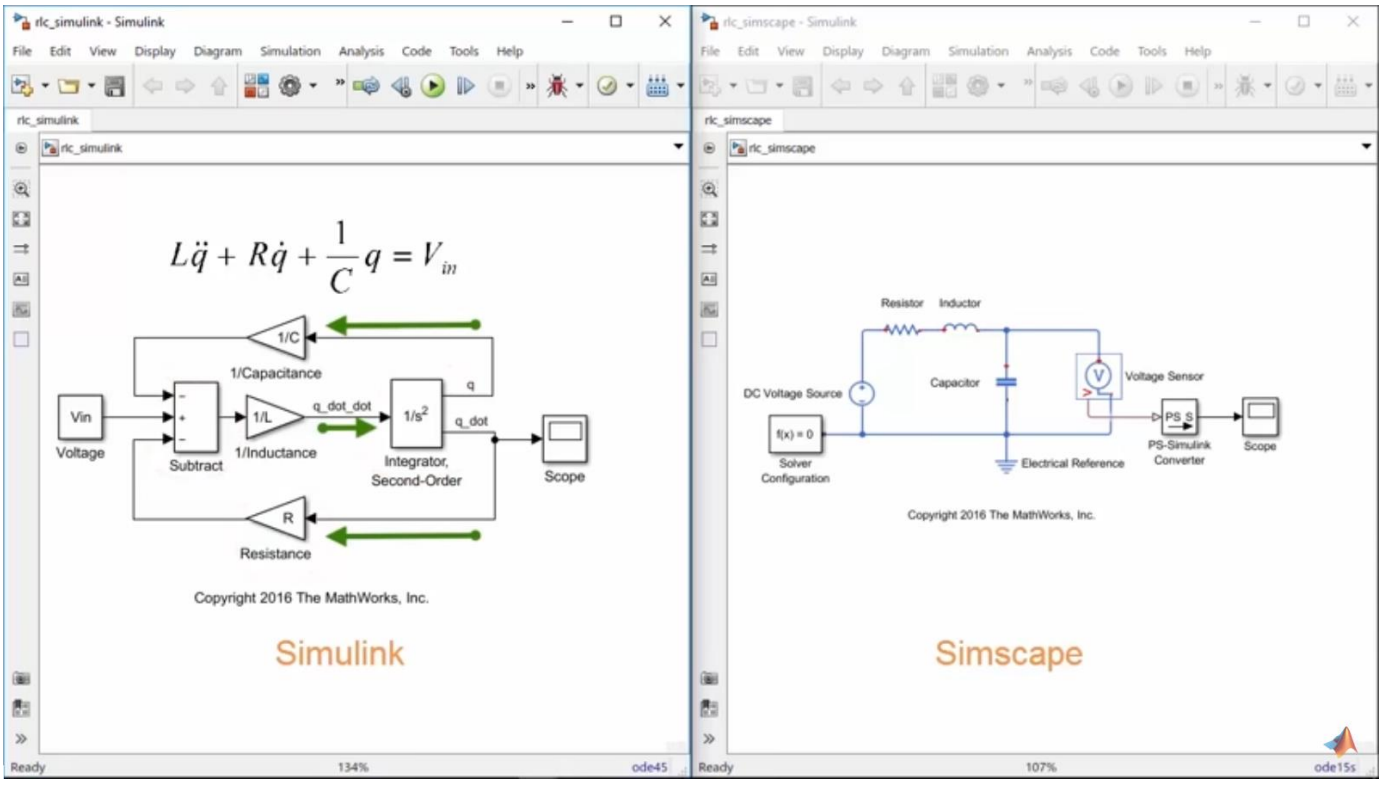
E-NTU Heat Transfer

What is Simscape?

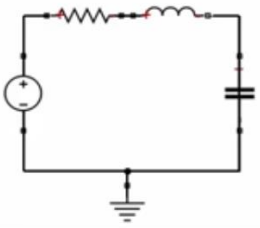
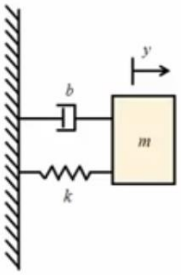
- Extends Simulink with libraries for modeling and simulating multidomain physical systems
- Contains models of foundation elements for various physical domains
- Contains other capabilities useful when modeling physical systems (unit manager, data logging, etc.)



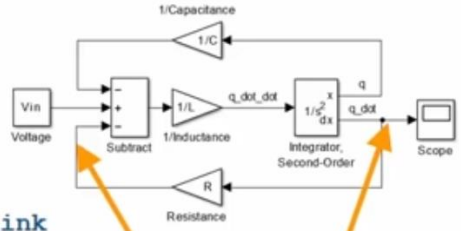




Modeling Differences Between Simulink and Simscape

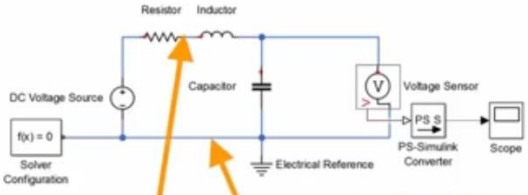
	Represented using equations	Represented using diagram
RLC circuits	$L\ddot{q} + R\dot{q} + \frac{1}{C}q = V_{in}$	
Mass-spring-damper	$m\ddot{y} + b\dot{y} + ky = 0$	

Modeling Differences Between Simulink and Simscape (Electrical System)




```
>>rlc_simulink
```

Connections represent signal transmissions




```
>>rlc_simscape
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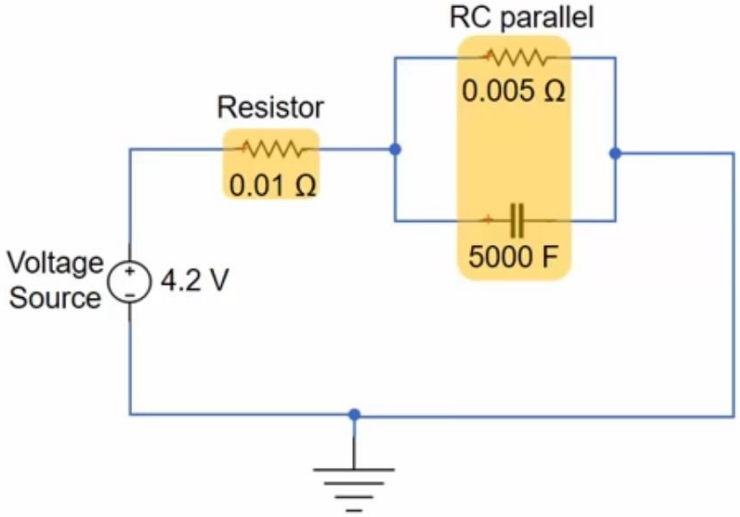
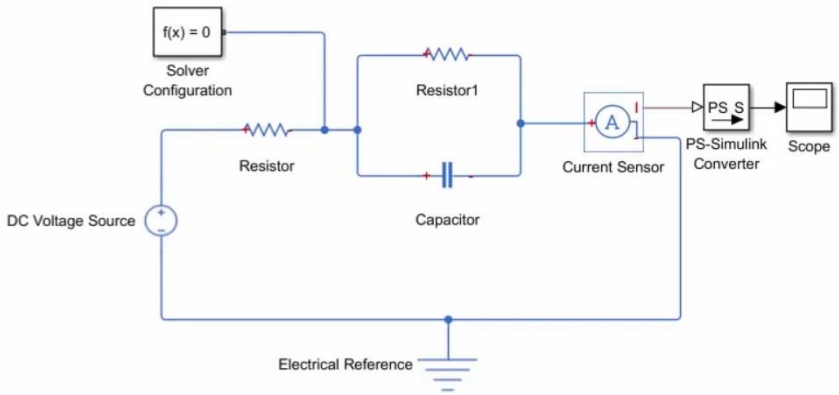
Connections represent physical connections

RC Circuit



Building the Simscape Model

- Simscape
  - Foundation Library
    - Electrical
      - Electrical Elements
      - Electrical Sensors
      - Electrical Sources
    - Gas
    - Hydraulic
    - Magnetic
    - Mechanical
    - Physical Signals
    - Thermal
    - Thermal Liquid
    - Two-Phase Fluid
  - Utilities
  - Driveline
  - Electronics
  - Fluids
  - Multibody
  - Power Systems



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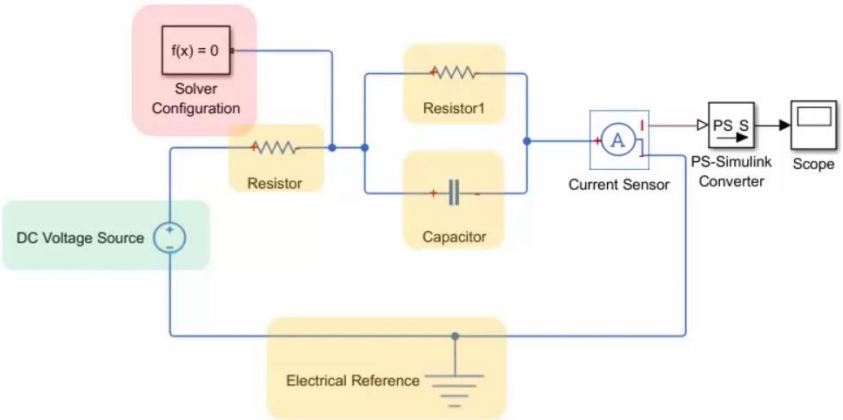
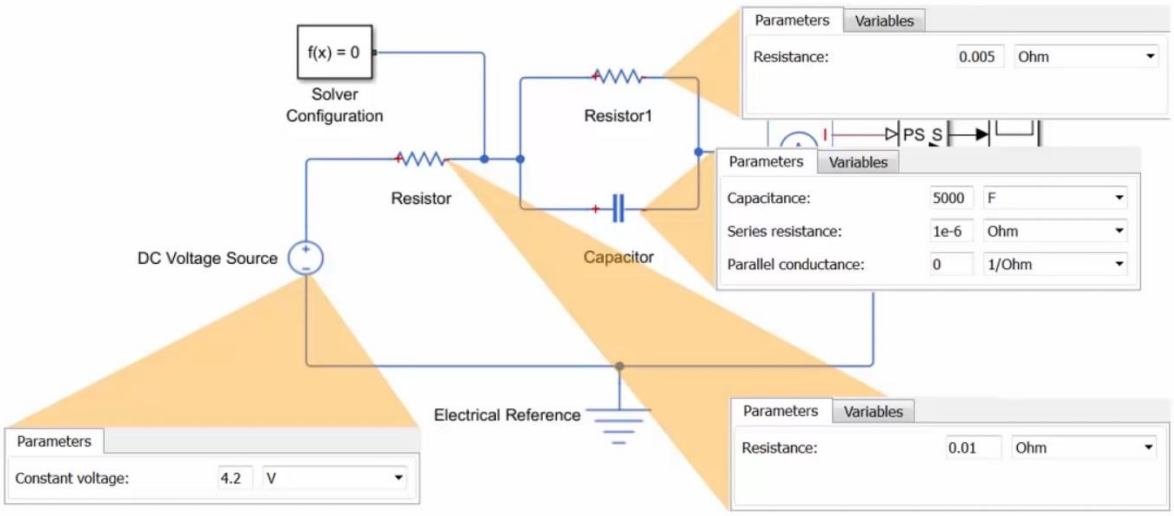
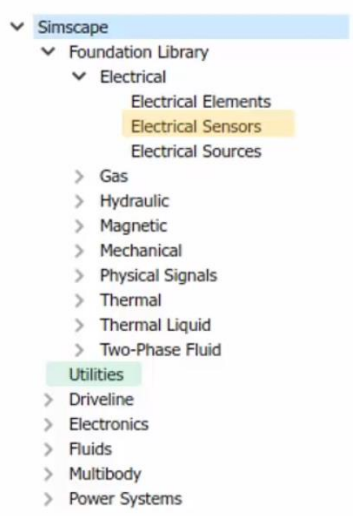
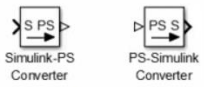


Setting Block Parameters

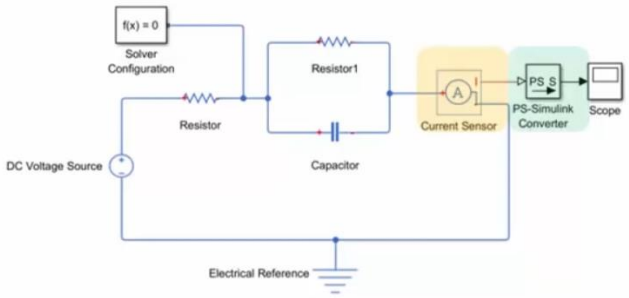


Measuring the Current

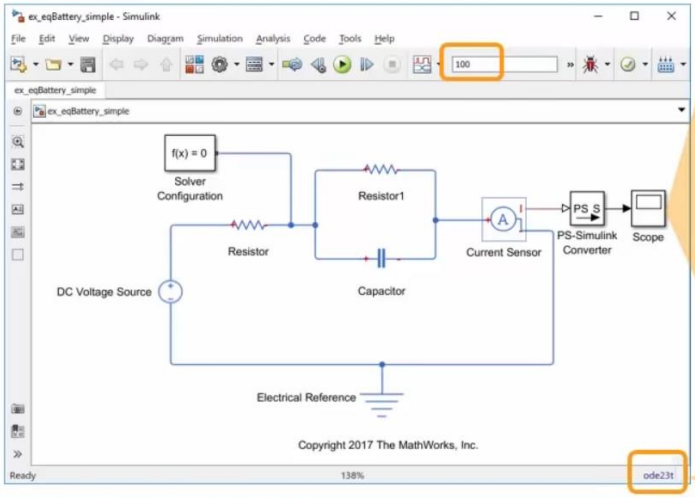


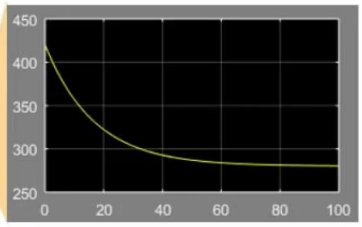


Blocks to interface Simulink and physical signals



Simulating a Simscape Model





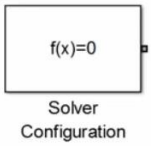

```
>>ex_eqBattery_simple
```

ode15s
ode23t
ode14x (fixed step)

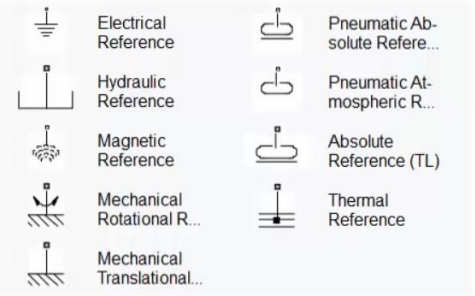
Use a recommended solver with Simscape models.

Important Blocks

Solver Configuration block

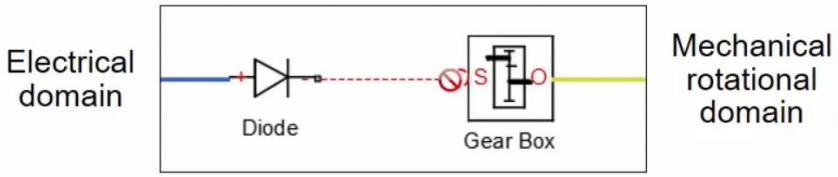


Domain specific reference block



Connection Guidelines

You can only connect two physical connection ports of the same physical domain.




```
>>connect_blocks
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