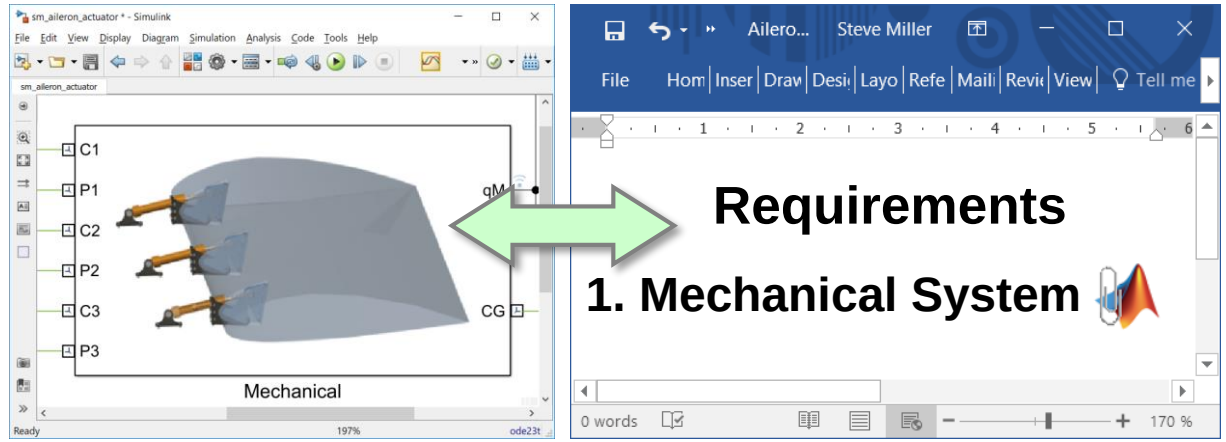
MATLAB EXPO 2018

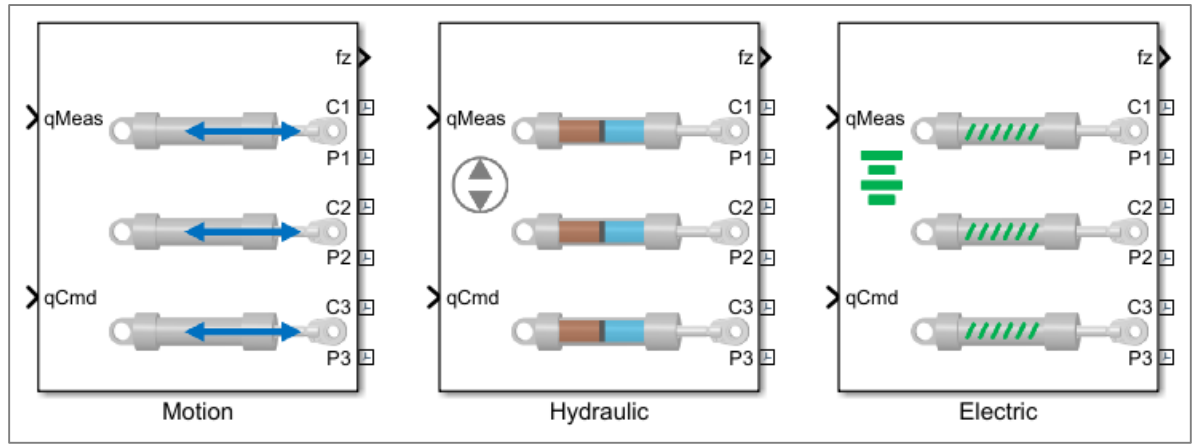
Entwicklung mechatronischer Systeme in der Luft- und Raumfahrt

Eva Pelster

Key Points

- Create intuitive models that all teams can share
- Simulate system in one environment to
  - Perform tradeoff studies
  - Optimise system performance
- Test without prototypes





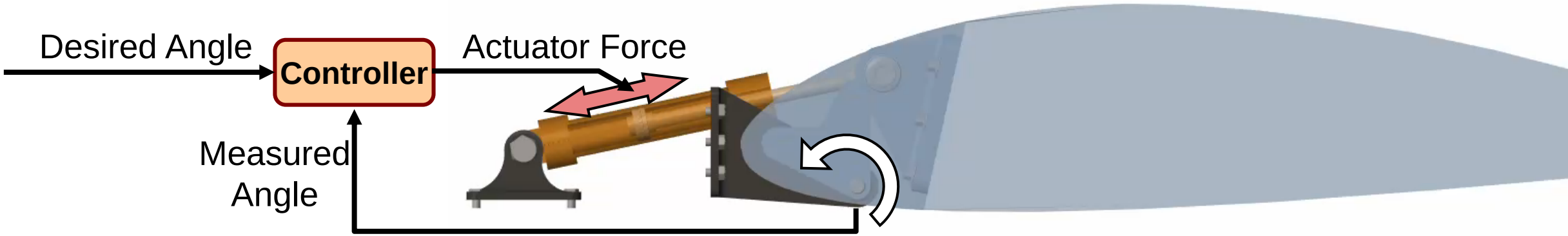
Configure Model → **Real-Time Hardware** → **Generate C Code** → **Tune Parameter**

Agenda

- Example: Flight actuation system
  - Benefits of Model-Based Design
- Actuator design
  - Modeling the mechanical system
  - Determining actuator requirements
  - Testing Electrical and Hydraulic Designs
- Optimising System-Level Design
- HIL testing

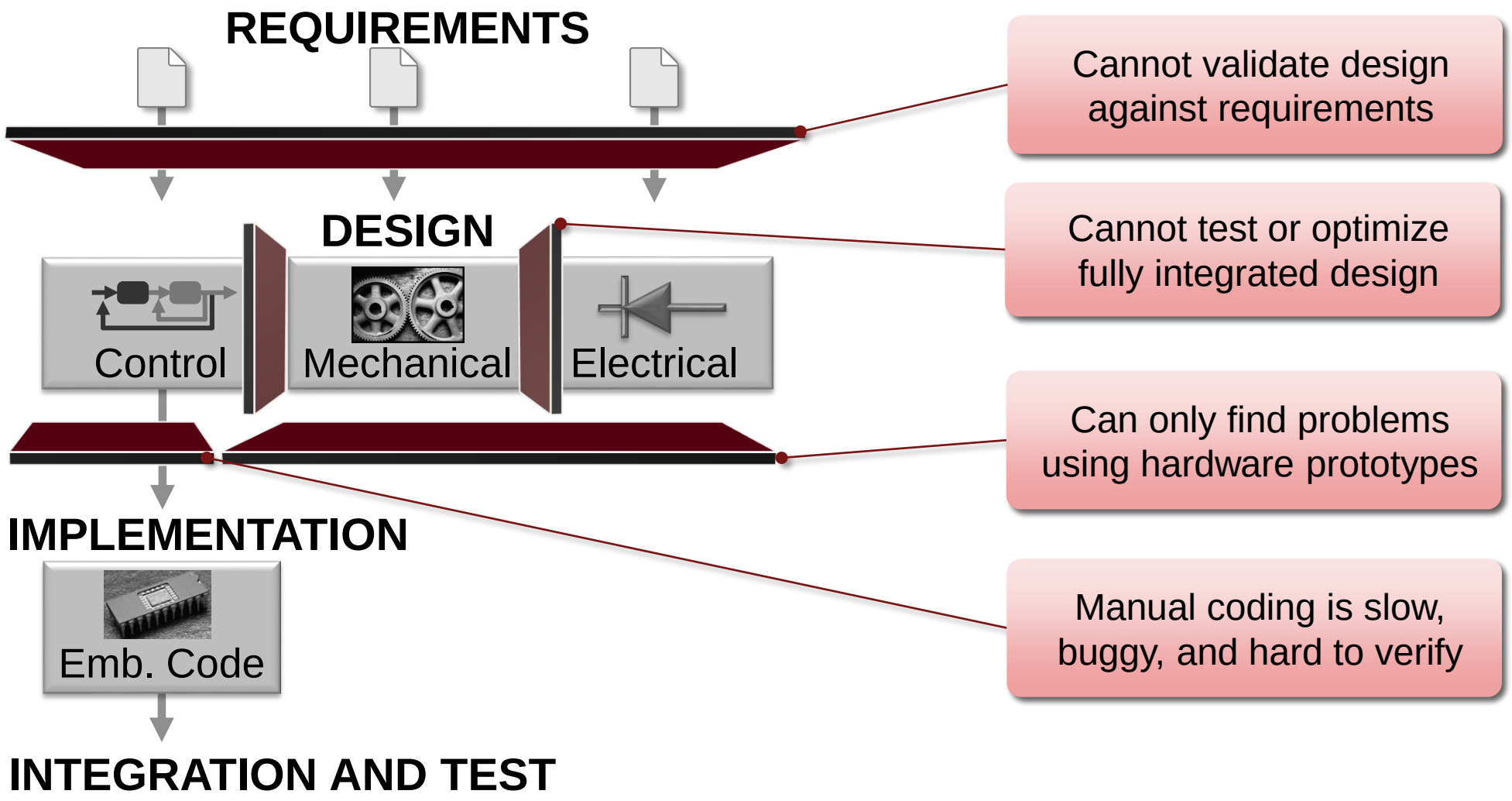
Example: Aileron Actuation System

- System

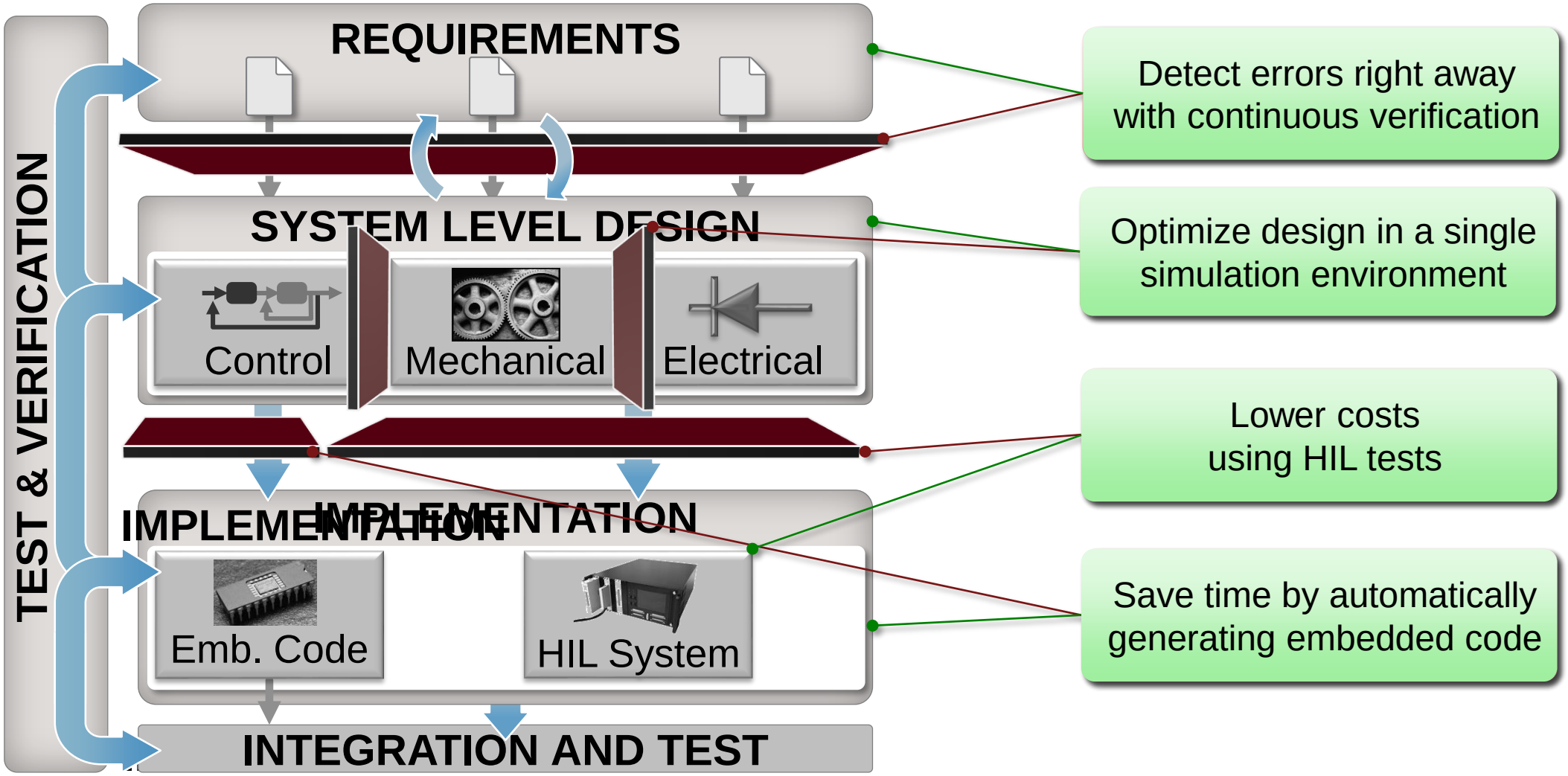


- Simulation goals
  1. Determine requirements for actuation system
  2. Test actuator designs
  3. Optimise system performance
  4. Run simulation on real-time hardware for HIL tests

Traditional Design Process



Model-Based Design



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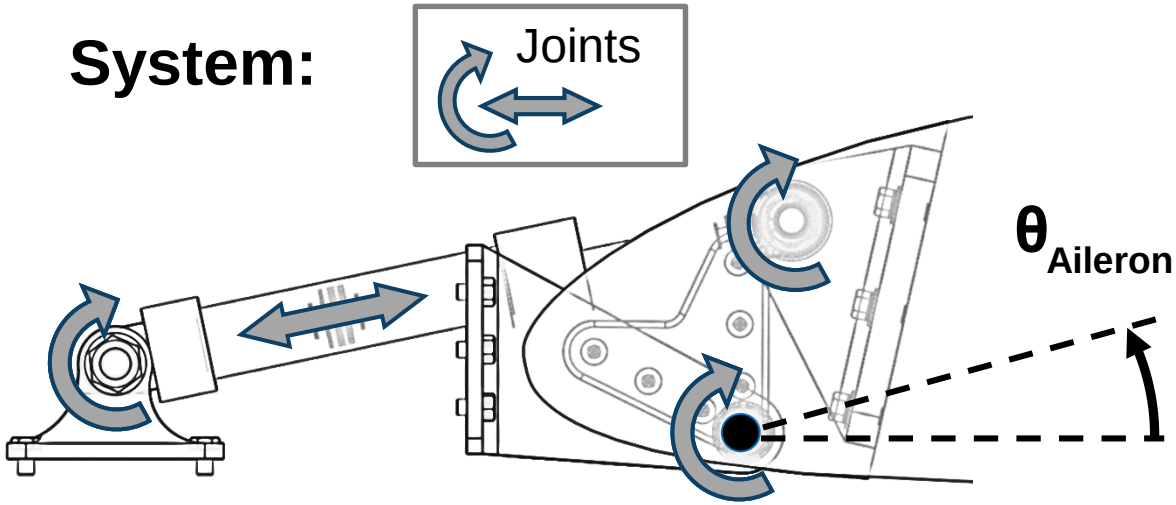
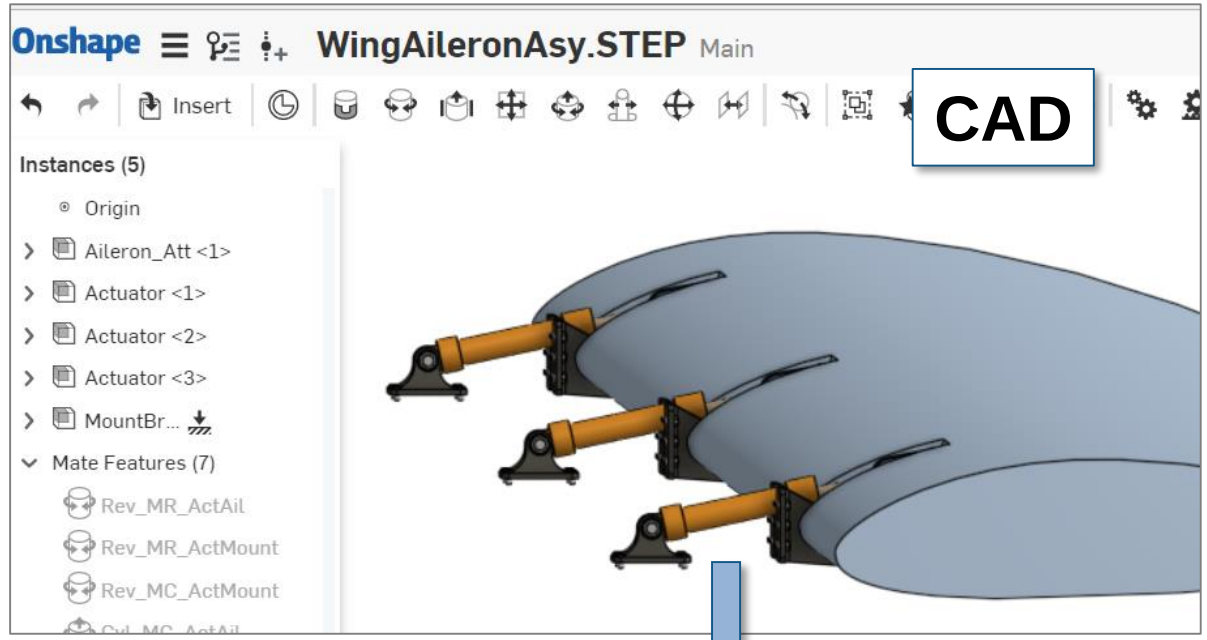
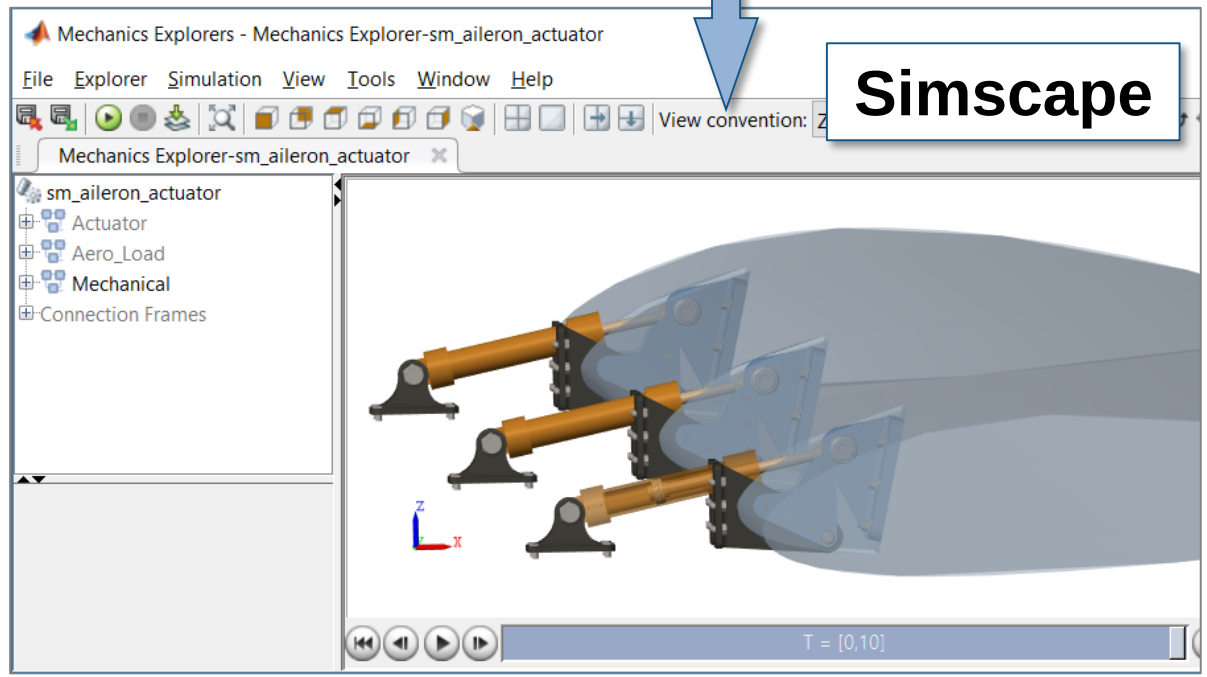
Modeling the Mechanical System

System:

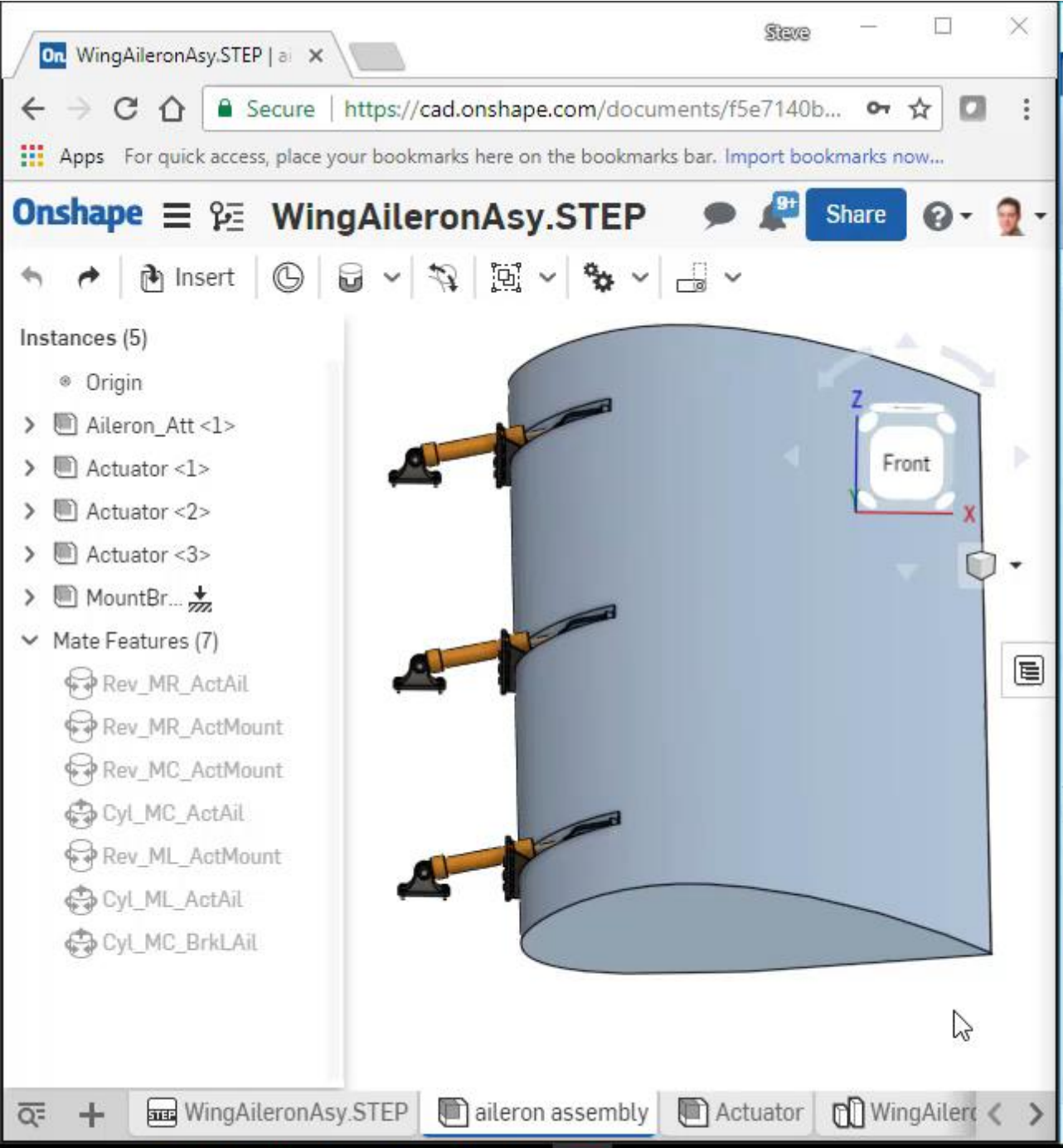






Problem: Model the mechanical system within Simulink

Solution: Import the mechanical model from CAD into Simscape Multibody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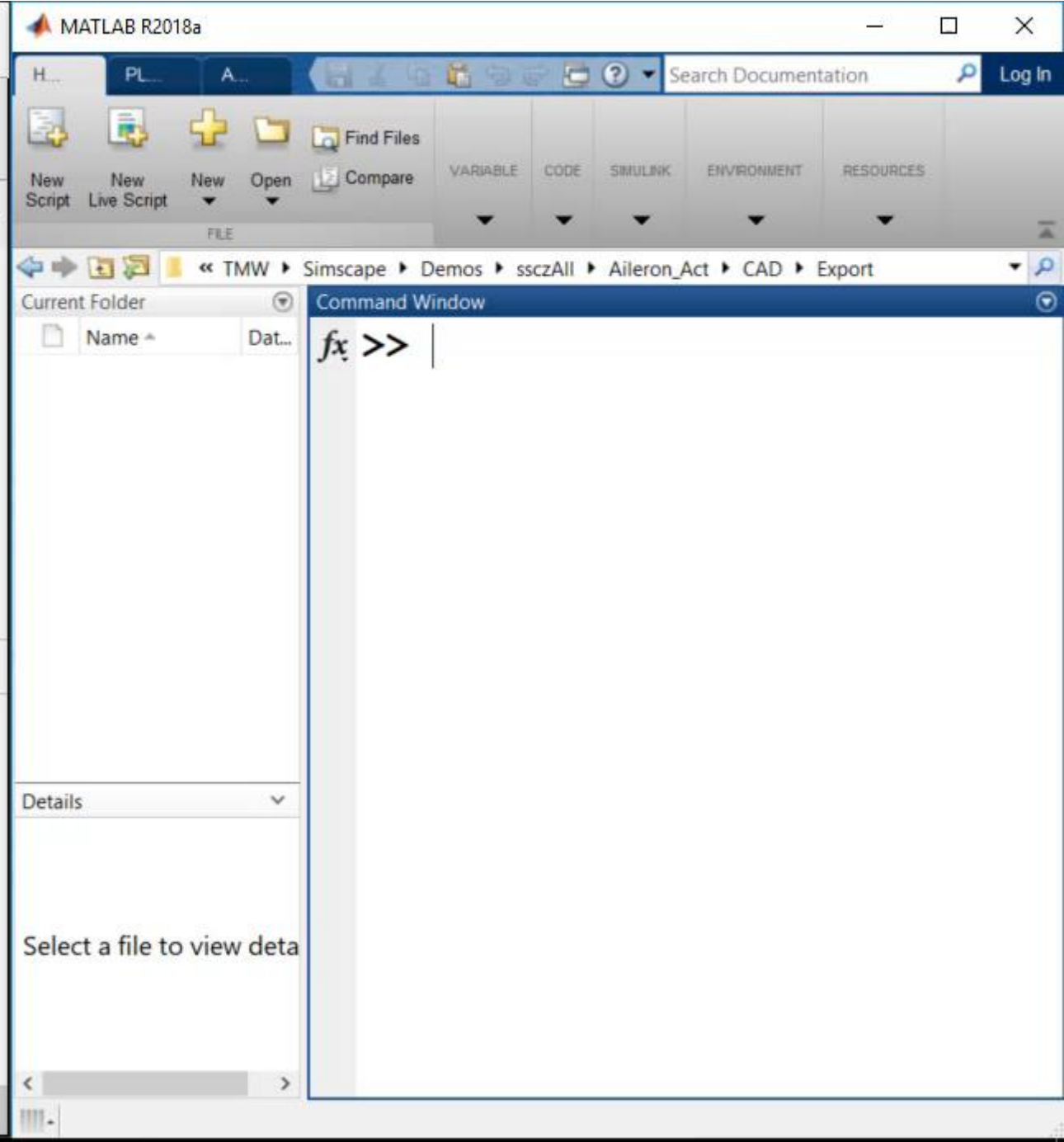
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Determining Actuator Requirements

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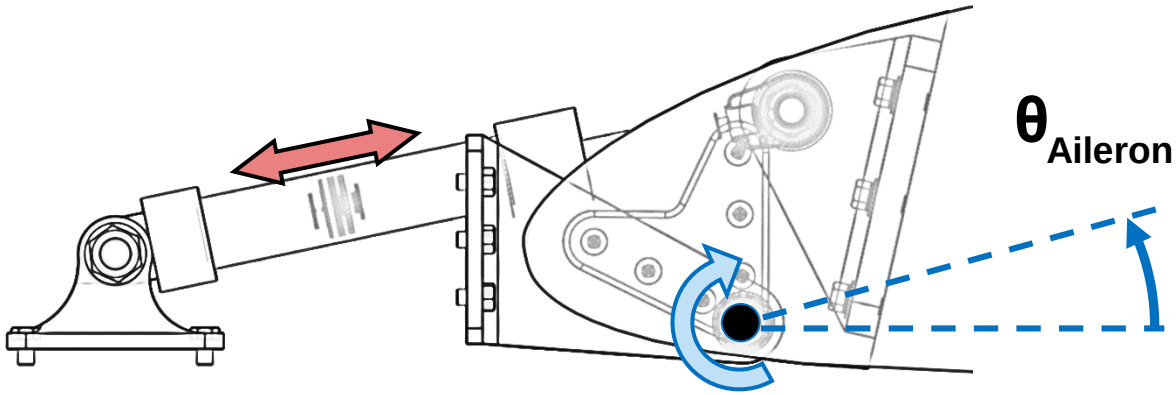
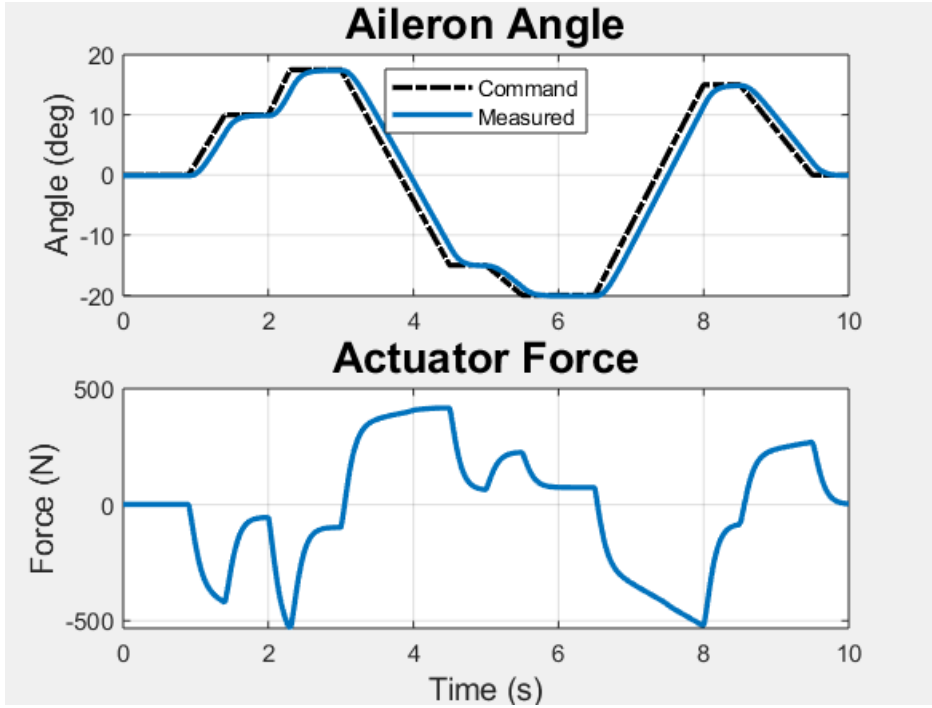
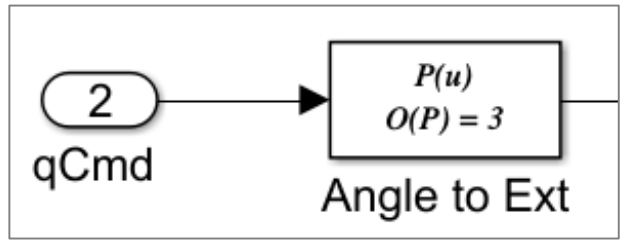
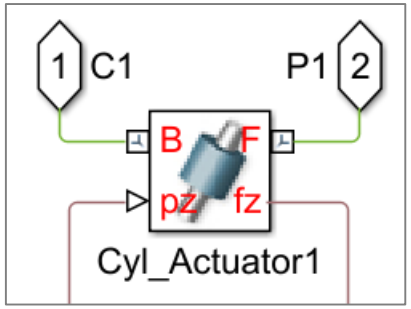




Problem: Determine the requirements for an aircraft aileron actuator

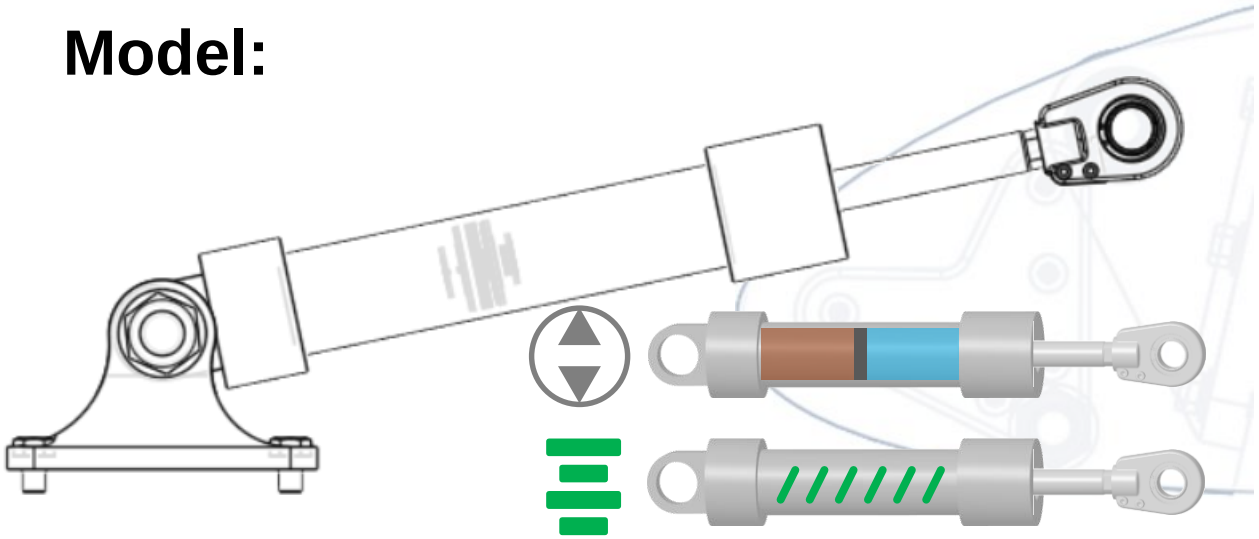
Solution: Use Simscape Multibody to model the aileron and Simscape to model an ideal actuator

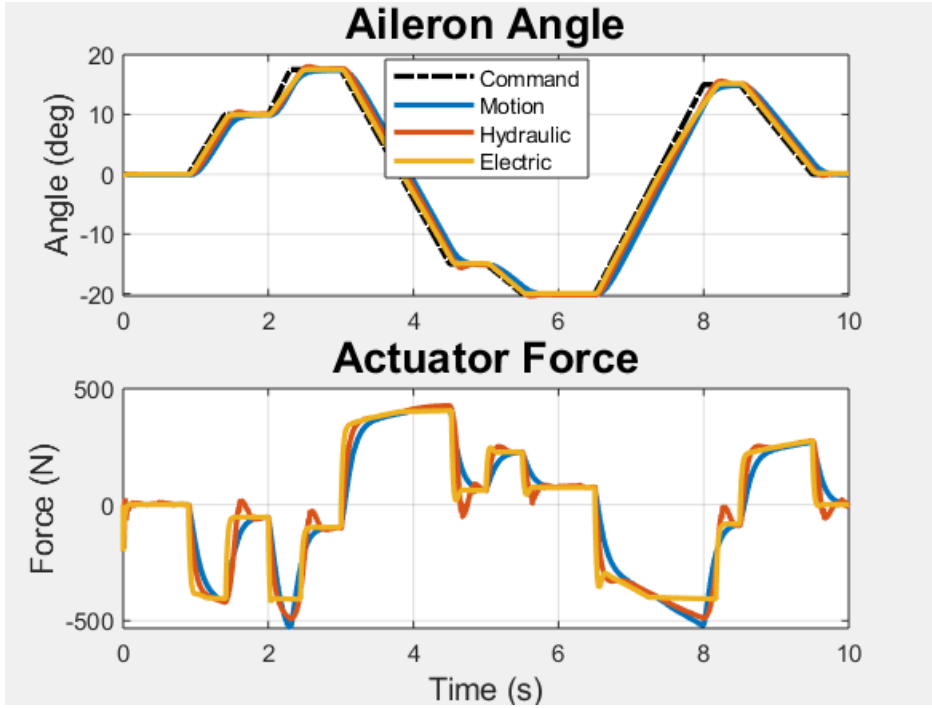




Testing Electrical and Hydraulic Designs

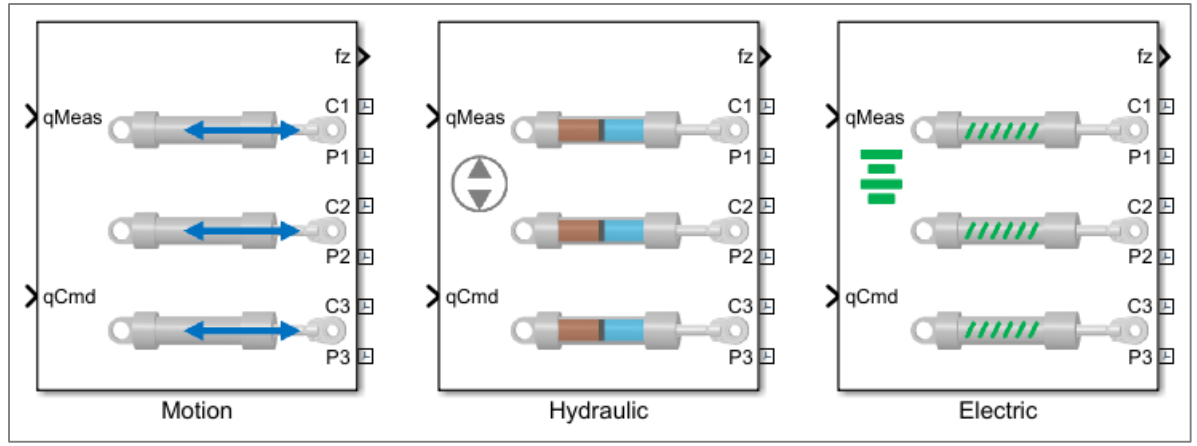
Model:





Problem: Test different actuator designs in the system

Solution: Use Simscape Fluids and Simscape Electronics to model the actuators, and variant subsystems to test them



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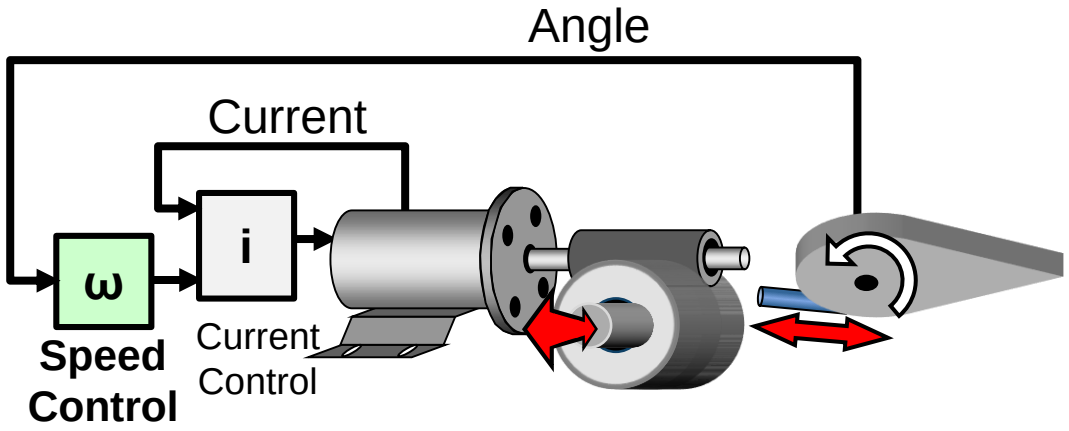
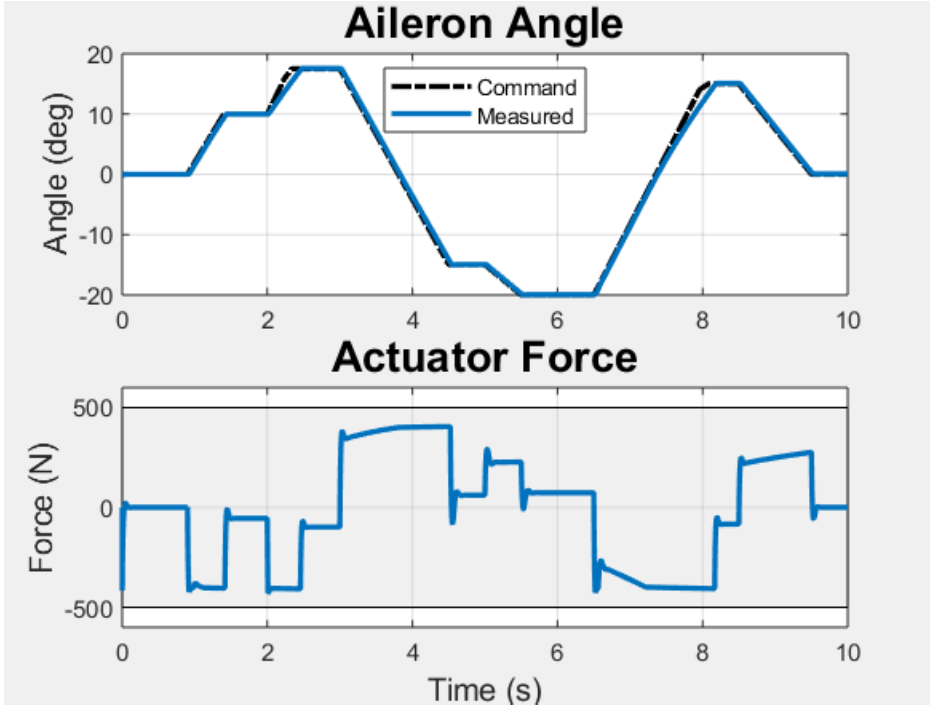
Optimising System Performance

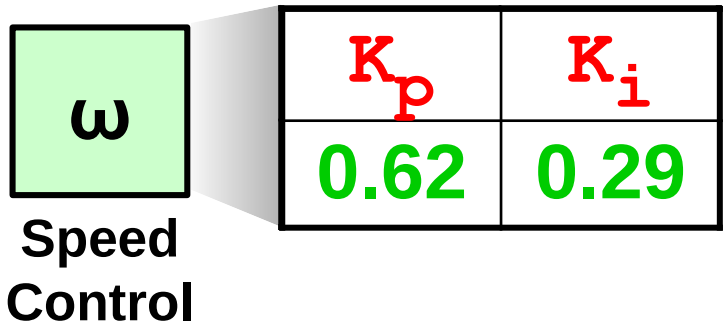
Model:

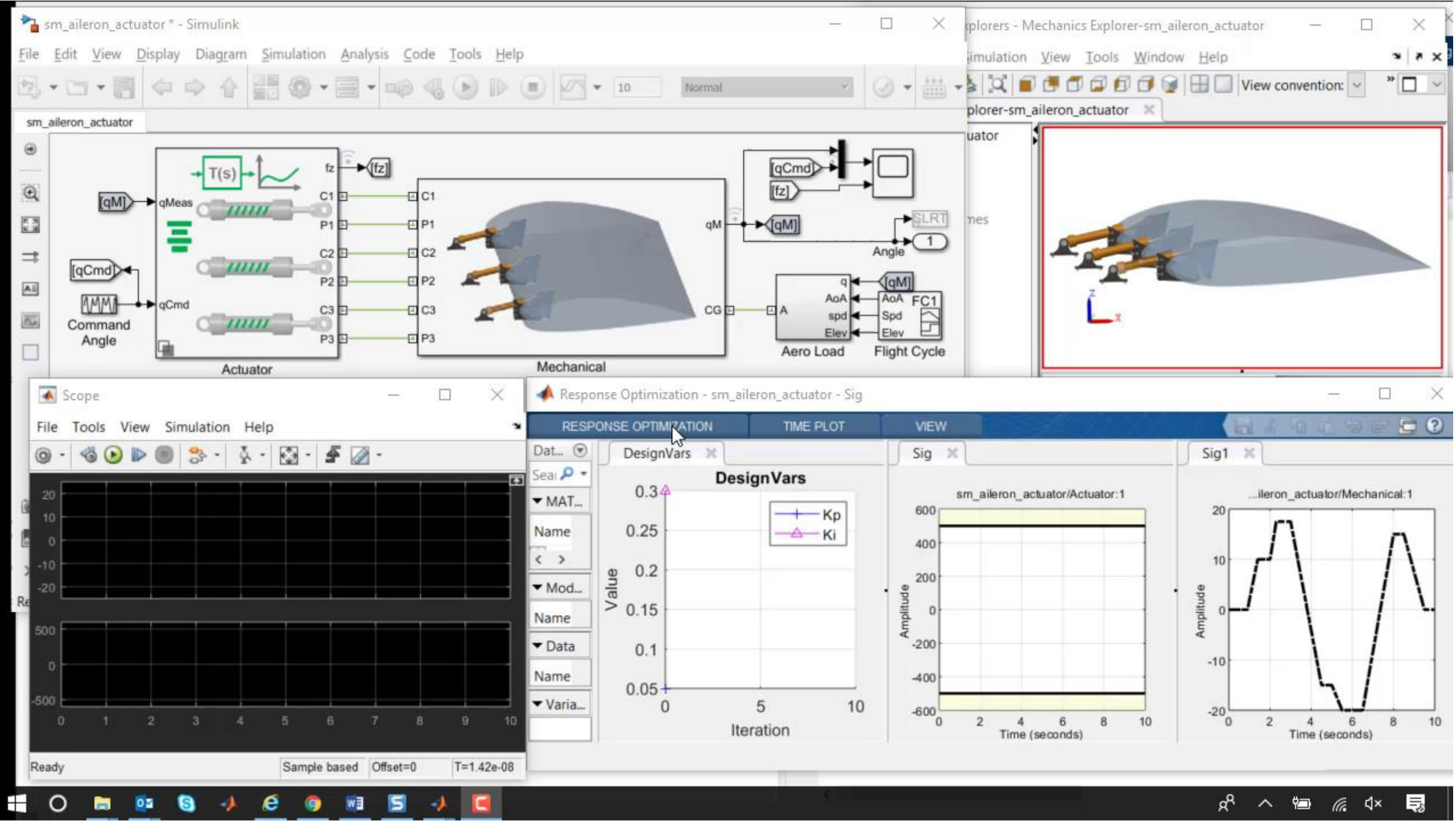




Problem: Optimise the speed controller to meet system requirements

Solution: Tune controller parameters with Simulink Design Optimization

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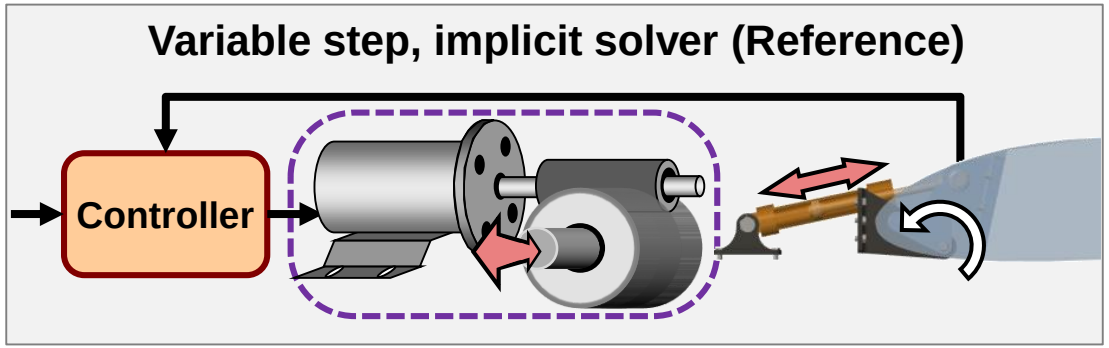
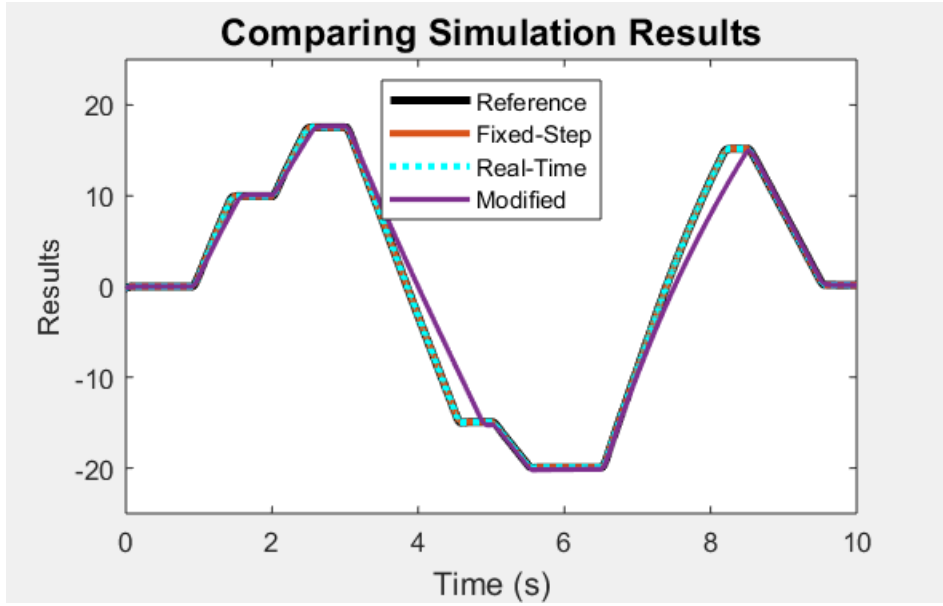
Configuring an Electrical Actuator for HIL Testing

Model:



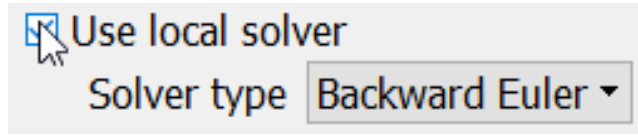
Numerically Stiff System



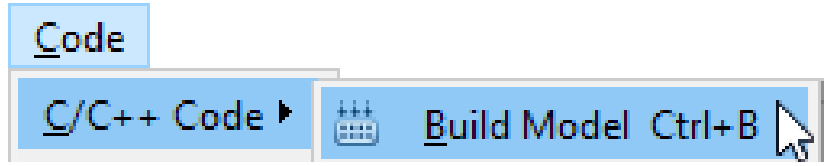
Problem: Configure solvers to minimize computations and convert to C code for real-time simulation

Solution: Use Simscape local solvers on stiff physical networks and Simulink Coder™ to generate C code

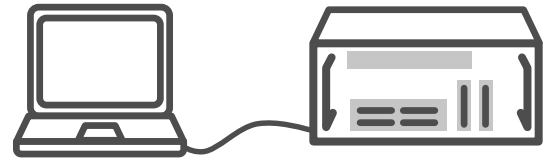
Configure Model



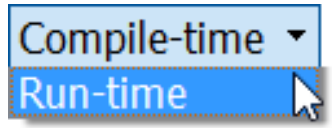
Generate C Code



Real-Time Hardware



Tune Parameter



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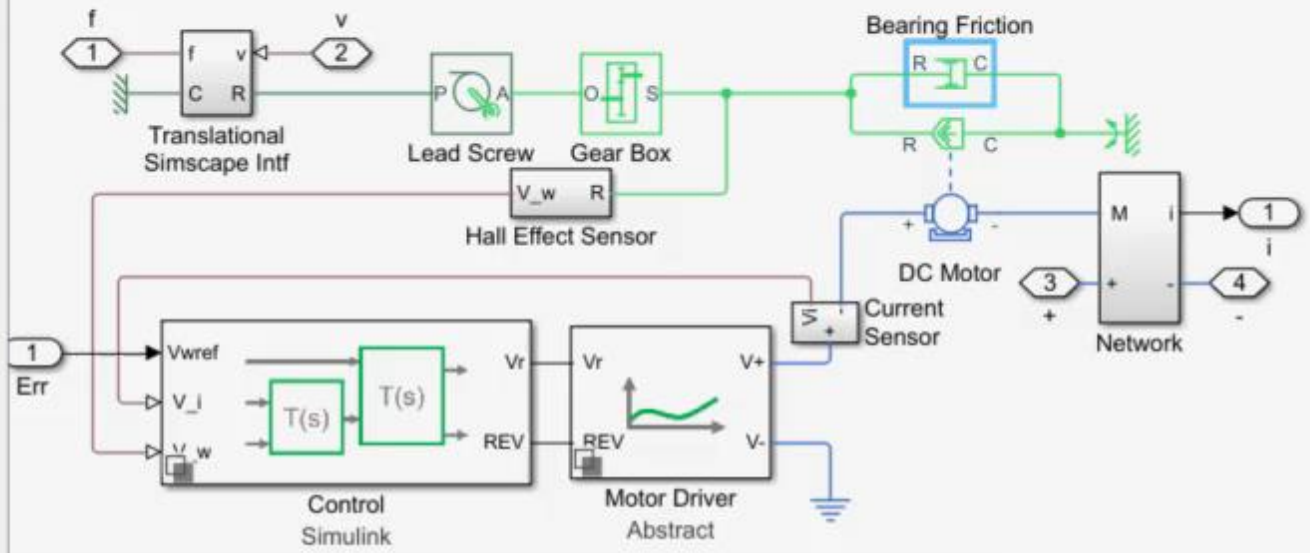
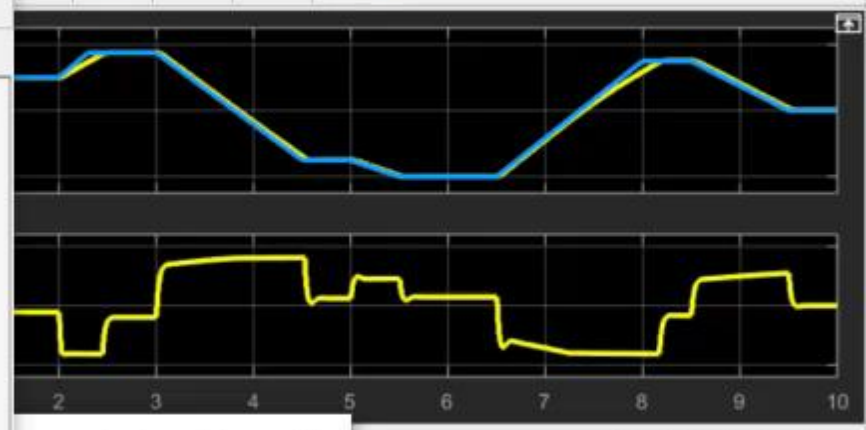


Simulation Help



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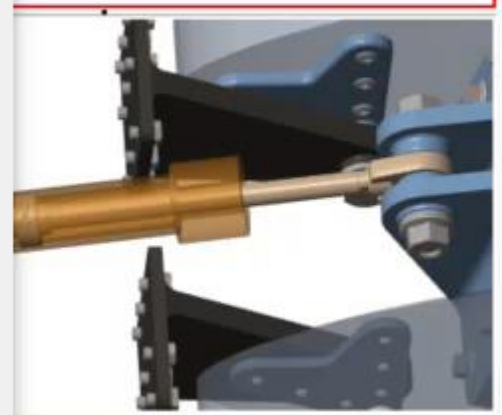
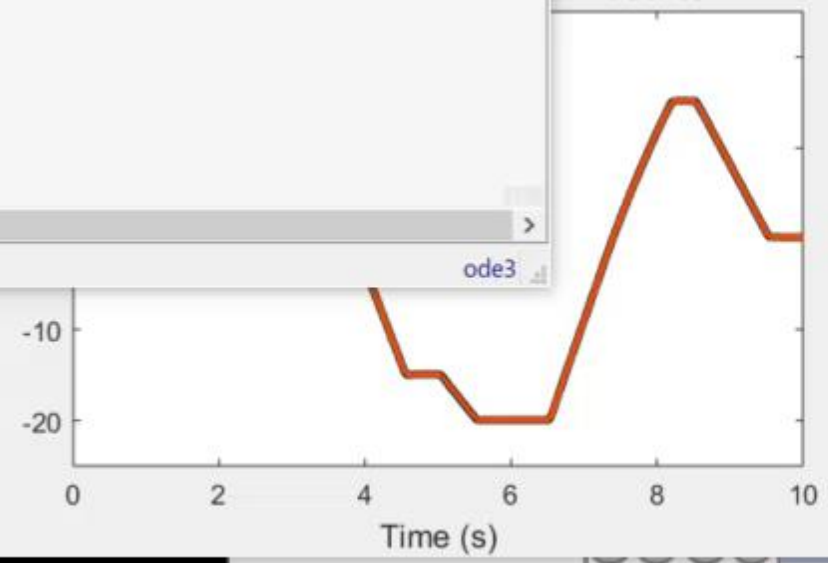
Results





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53    %% Build and download to real-time tar
54    % Set codegen target to slrt.tlc
55 -  set_param(mdl,'SimMechanicsOpenEditorC
56 -  slbuild(mdl);
57
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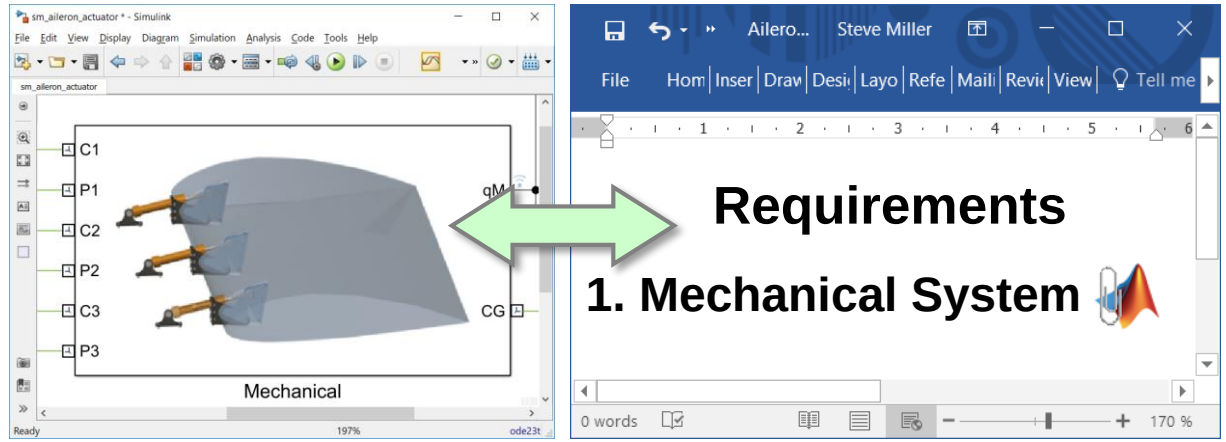

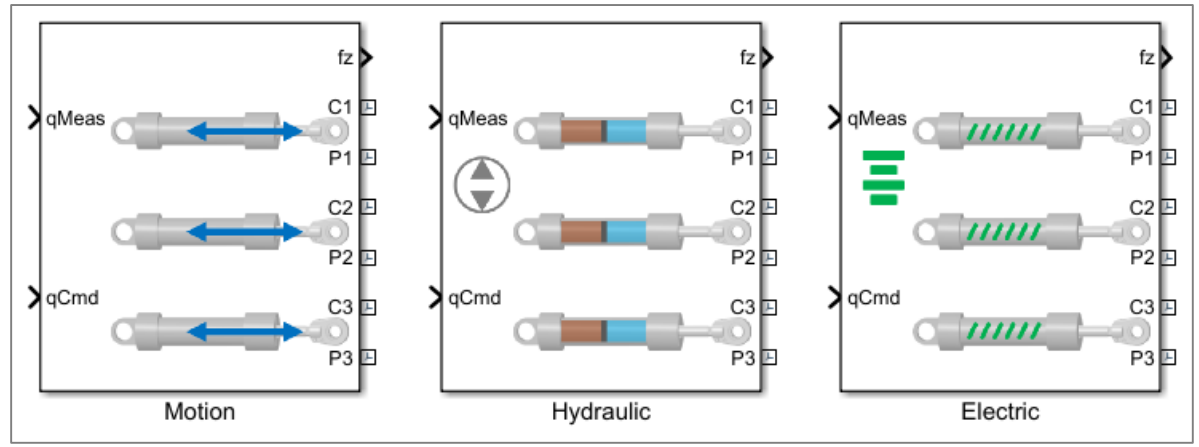

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