Elec 391 – 2022-W2

Mini-Project Description

Jan –Apr 2023

Software

- Design Pendulum
- Draw Motor
- Simscape Model

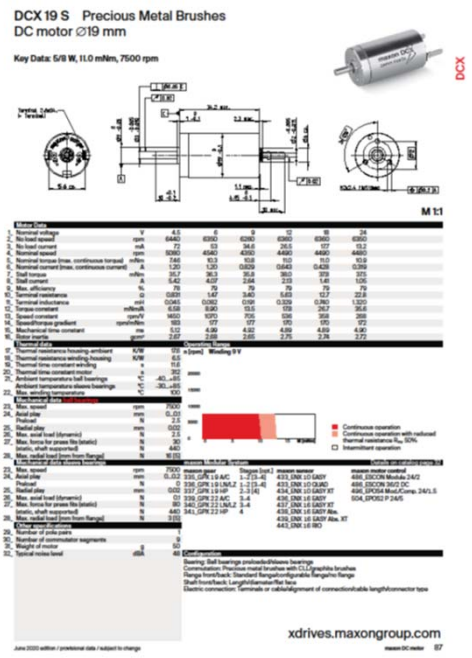
Hardware

- Program PLD
- Demo PLD on Breadboard
- Draw PCB

Software System

Identify motor using maxmot.p

- Physical Dimensions
- Winding R & L
- Rotor Inertia
- Robot Friction
  - Dynamic only
  - Model as linear damper

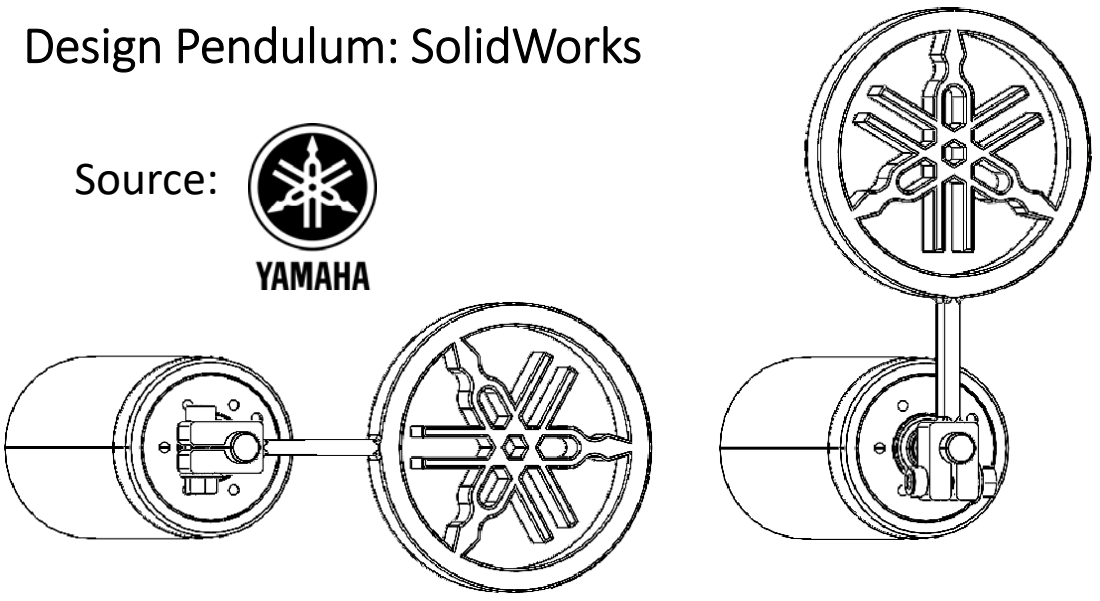

DCX 19 S Precious Metal Brushes
DC motor ∅19 mm
Key Data: 5/8 W, 11.0 mNm, 7500 rpm
DCX
M 1:1
xdrives.maxongroup.com

maxmot.p

- Download from Canvas
- Enter Student Number
- Look up Page & Voltage from DCX catalog

Design Pendulum: SolidWorks

Source: YAMAHA



Start Angle = 0°

End Angle = 90°

Download motor model

- maxongroup .com
- Brushed DC motor
- STEP file
- Create simplified model

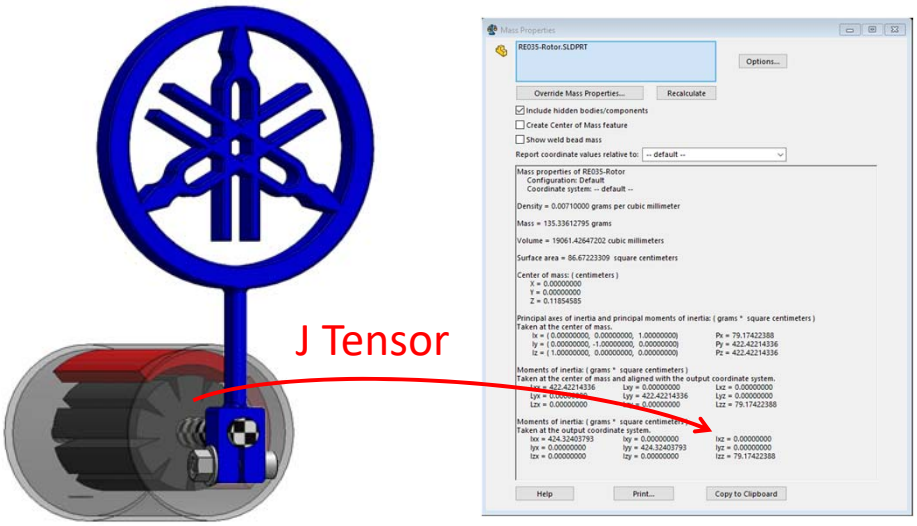
Custom Pendulum

- Pendulum contains logo of your choice
- Show source where you copied Logo
- Fits motor shaft
- Reasonable length
- 3003 Aluminum
- Compute Mass, Mass Centre, Inertia

SolidWorks Assembly File

- Motor (from Maxon)
- Pendulum
- Fasteners (from McMaster Carr)

Generate Motor & Simscape Model: SW



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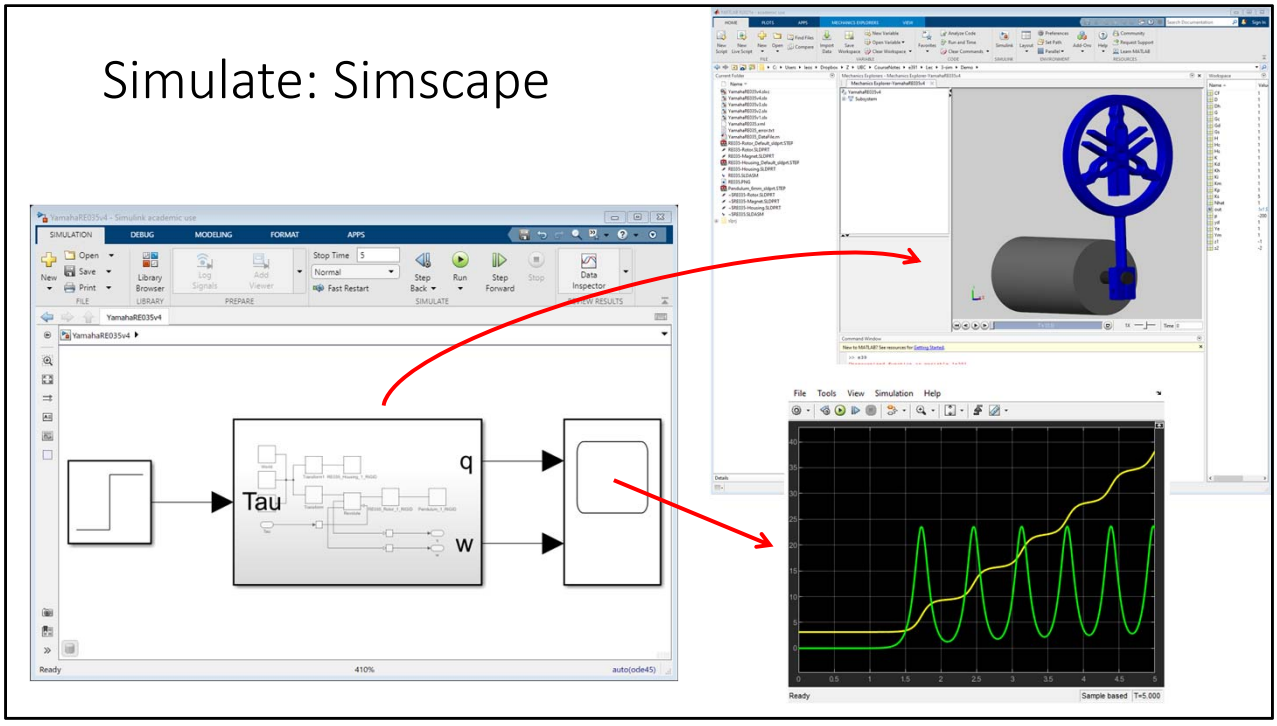
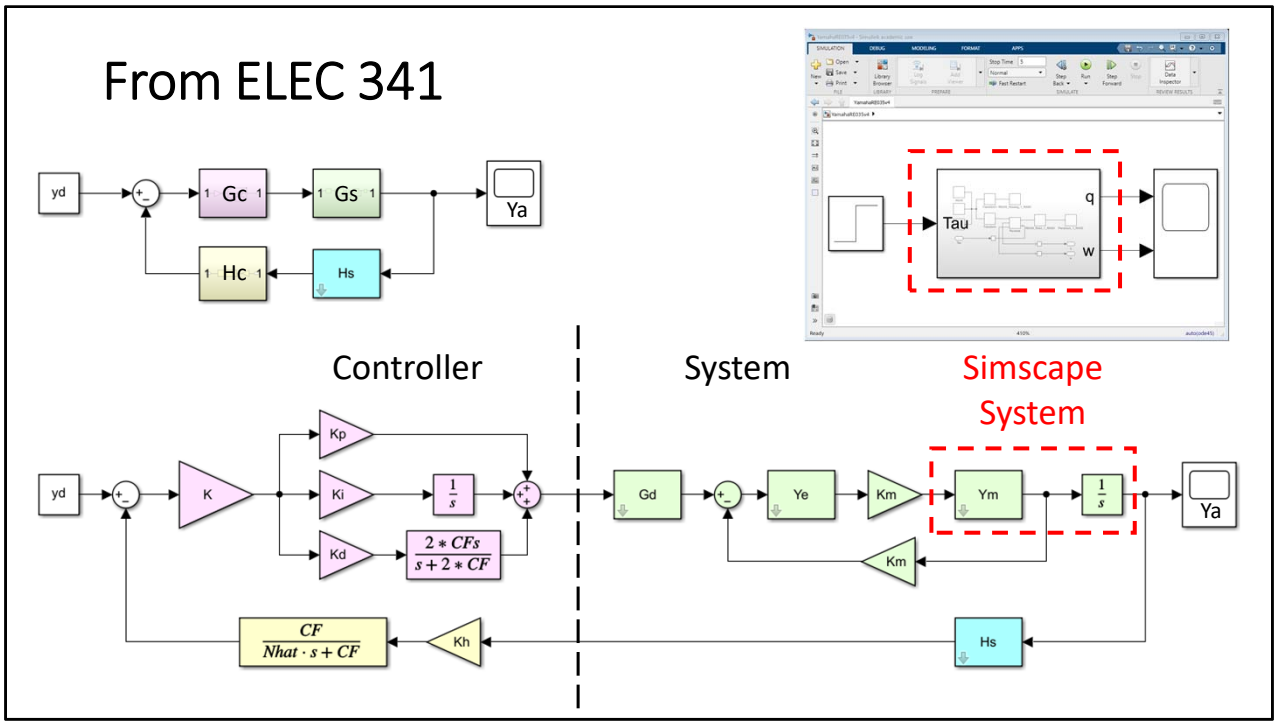
Simulate: Simscape



Configure Simscape model

- Mechanical parameters
- Inputs & Outputs
- Simulate
  - Animation
  - Plot Results



How is this used?

- Identify System
  - Develop Ym transfer function
- Compare to Simscape Model
- Use Ym to design controller
- Replace Ym and 1/s blocks in “rubber-stamp” control system model with Simscape Model
- Add non-linearities to Simscape Model
- Re-tune controller (Heuristic)
- Animate (Demonstrate)
- Compare to REAL system

Hardware System

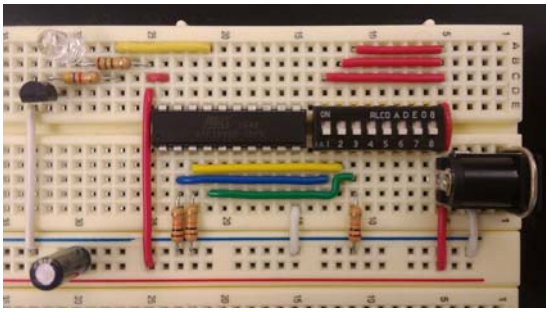
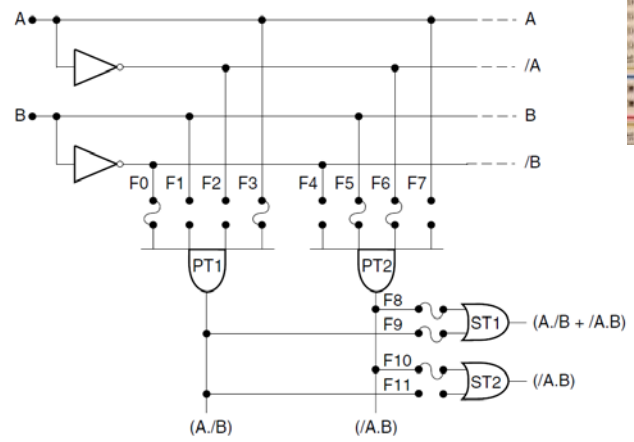
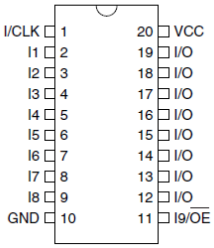


Figure 1-3. Elementary PLA architecture



DIP/SOIC



Programmable Logic Device

- Download from Canvas
- Enter Student Number
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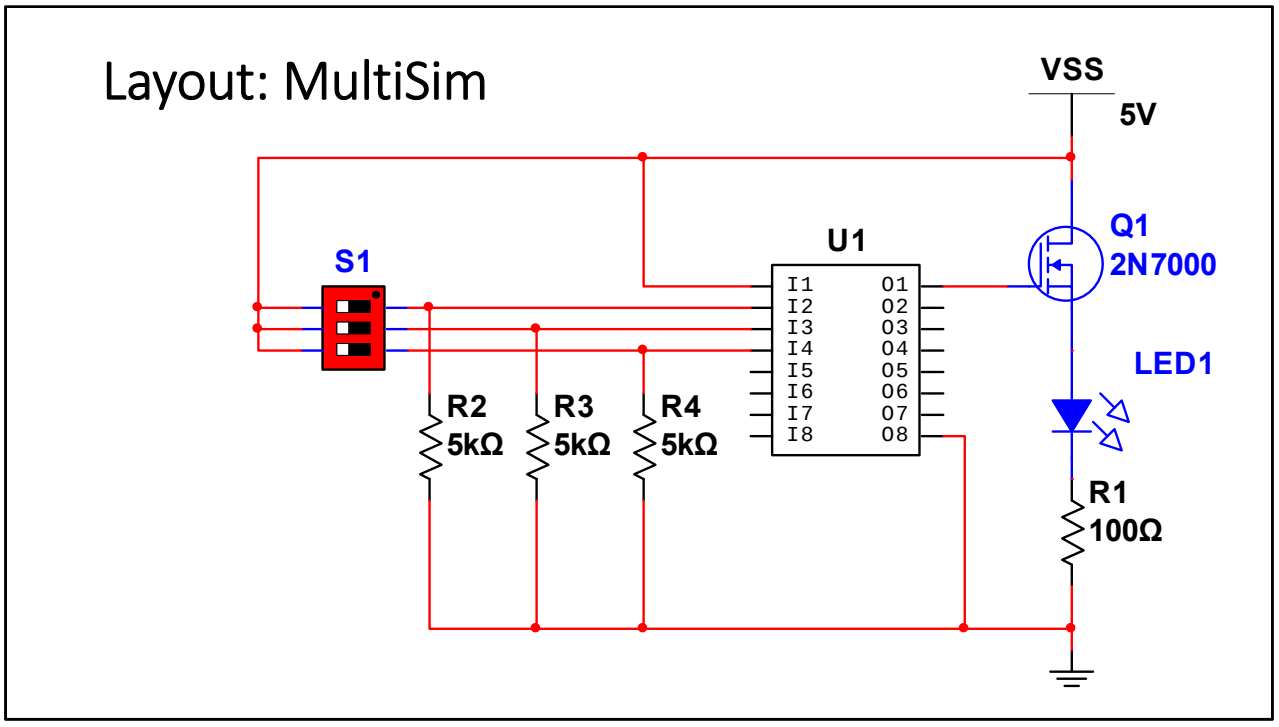
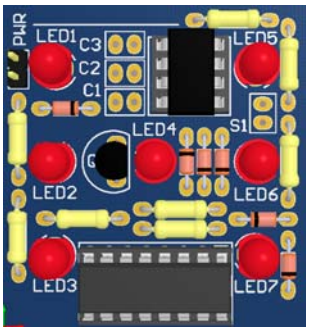
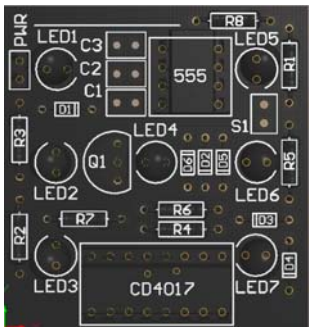


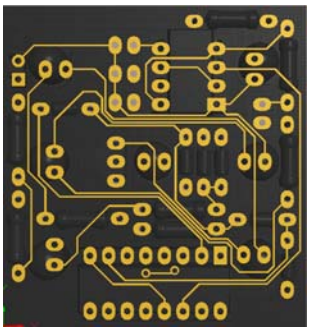
MultiSim Circuit

- Logic 1 = ON
- Logic 0 = OFF
- External power source

Design PCB: UltiBoard



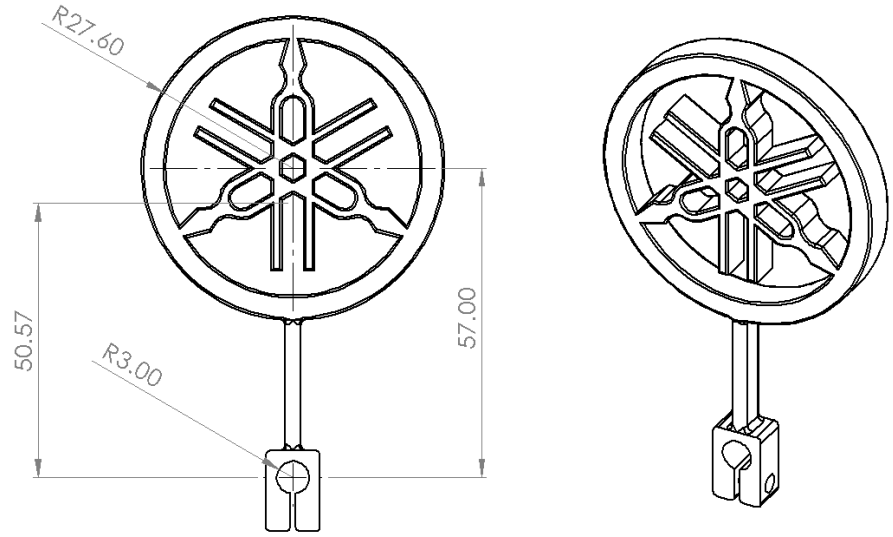




UltiBoard

- Layout PCB
- 2-Sided
- No wasted space
- Labels (silk screen layer)
- Connectors
- Mounting holes

Documentation



PPT Slides

- Evidence of work done
- At least 1 slide / task
- Slide-Deck Format
    - See e391ReportFormat.pdf