Mechanism Feasibility Design

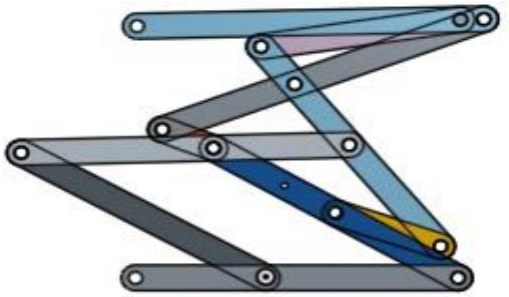
Tutorial Session Notes

Dr. James Gopsill

Last Week

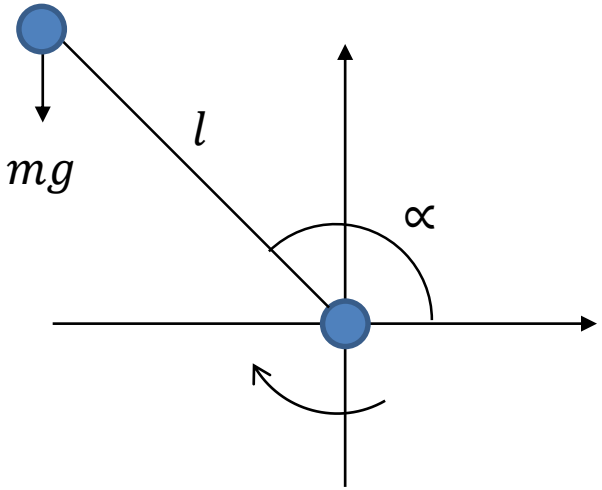
1. Shaft Design Feedback
2. Deployment Modelling
   - Demo: Stopping the simulation at a specific point
   - Demo: Adding damping to a system
   - Demo: Four-bar mechanism
3. Building Your Deployment Model
4. Evaluating Motor & Gear Ratios

You should have done - Boundary Calculation



What torque do you require to get the mechanism moving?

1. Assume a single mass
2. Calculate the centre of mass
3. Torque required by the pivot to get this mass moving

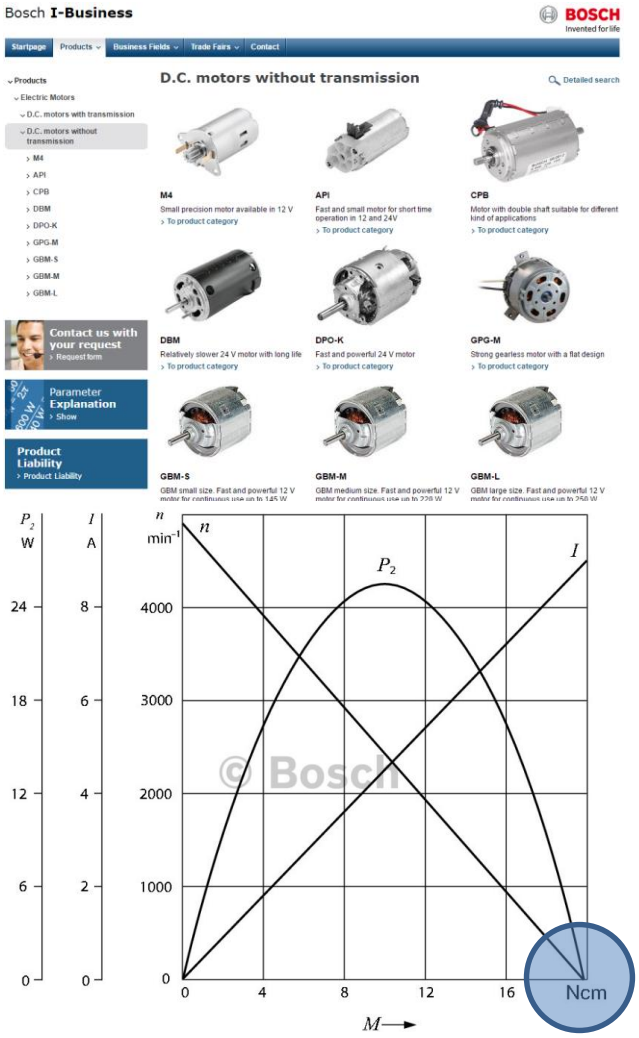


You should have done - Boundary Calculation

What motor and gear ratio is required to achieve this?

- Select a motor from Bosch
- Refer to your PDS when selecting the motor
- Determine the gear ratio required
- Note: you will need a gear ratio!
- Record your rationale for your choice

At the stage you're only focused at selecting the motor and gear ratio that will get your mechanism moving!

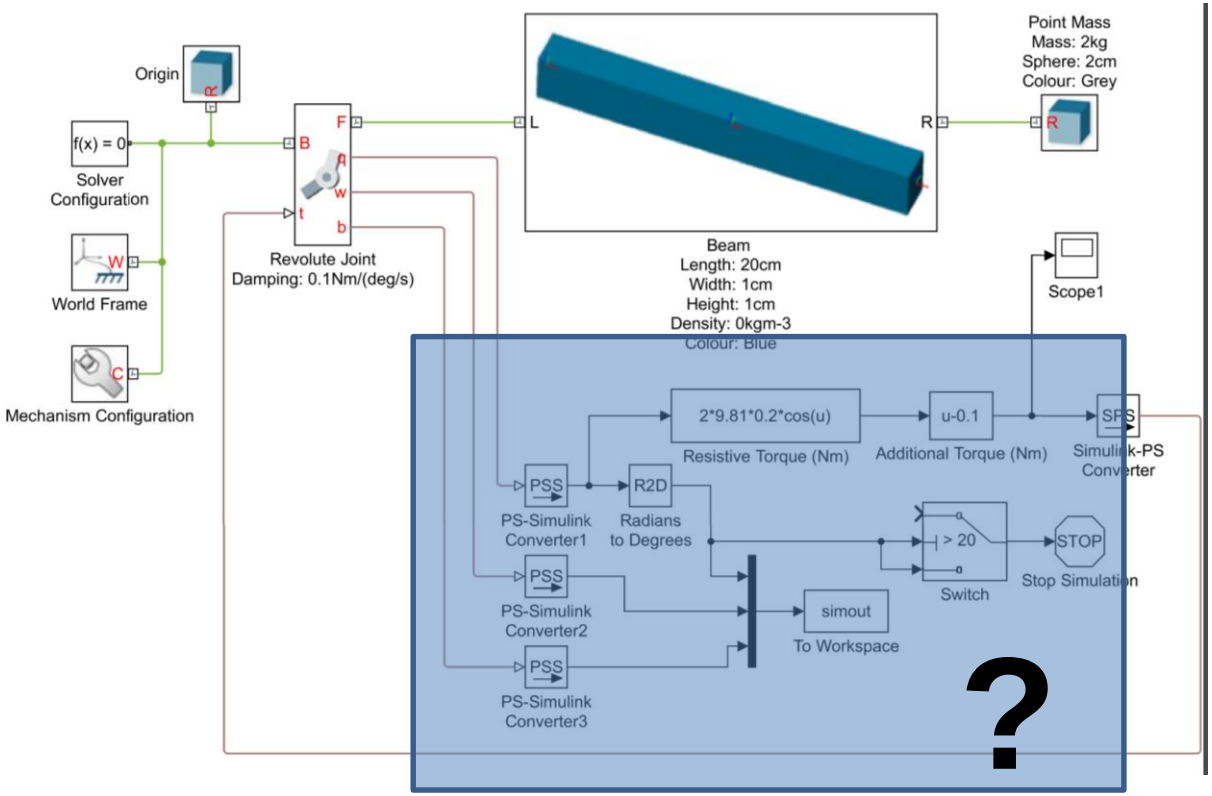


Putting it in Simulink

Now with a motor & gearbox selected.

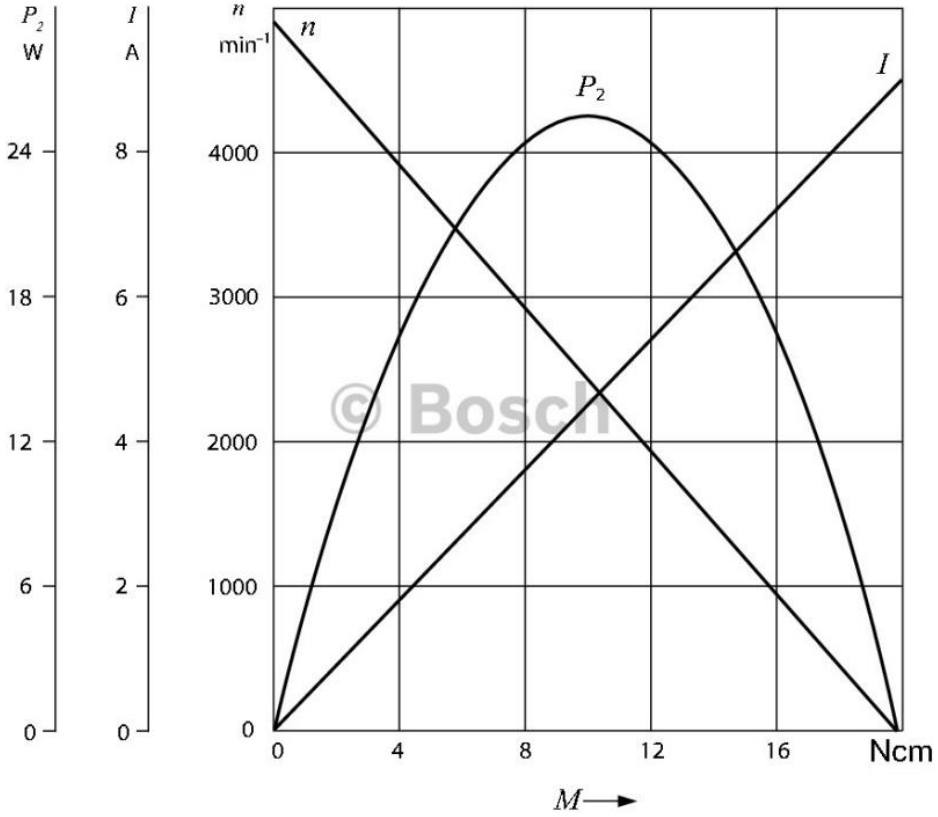
Focus on creating a simple pendulum using the values from your boundary calculation.

Purpose: Focus on how you model and provide feedback from your motor and gearbox



Notes on the Motor

- Not focusing on the control system
- Imagine it switching on and running along the torque/speed line



Notes on the Motor

- Not focusing on the control system
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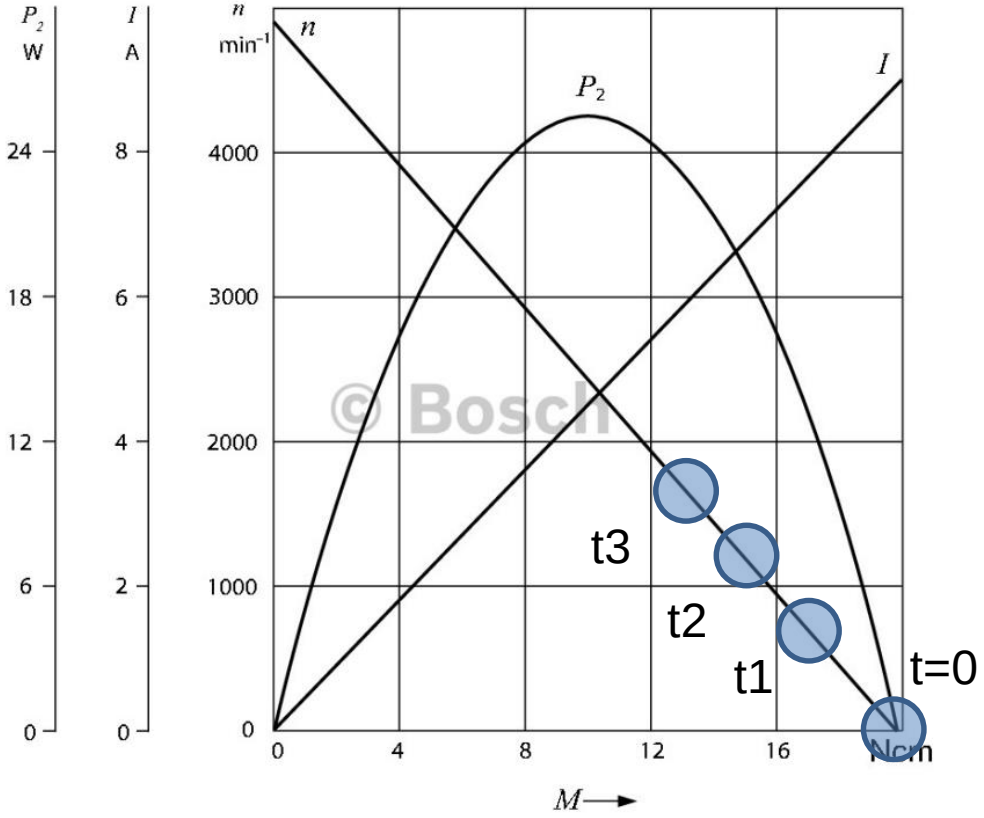
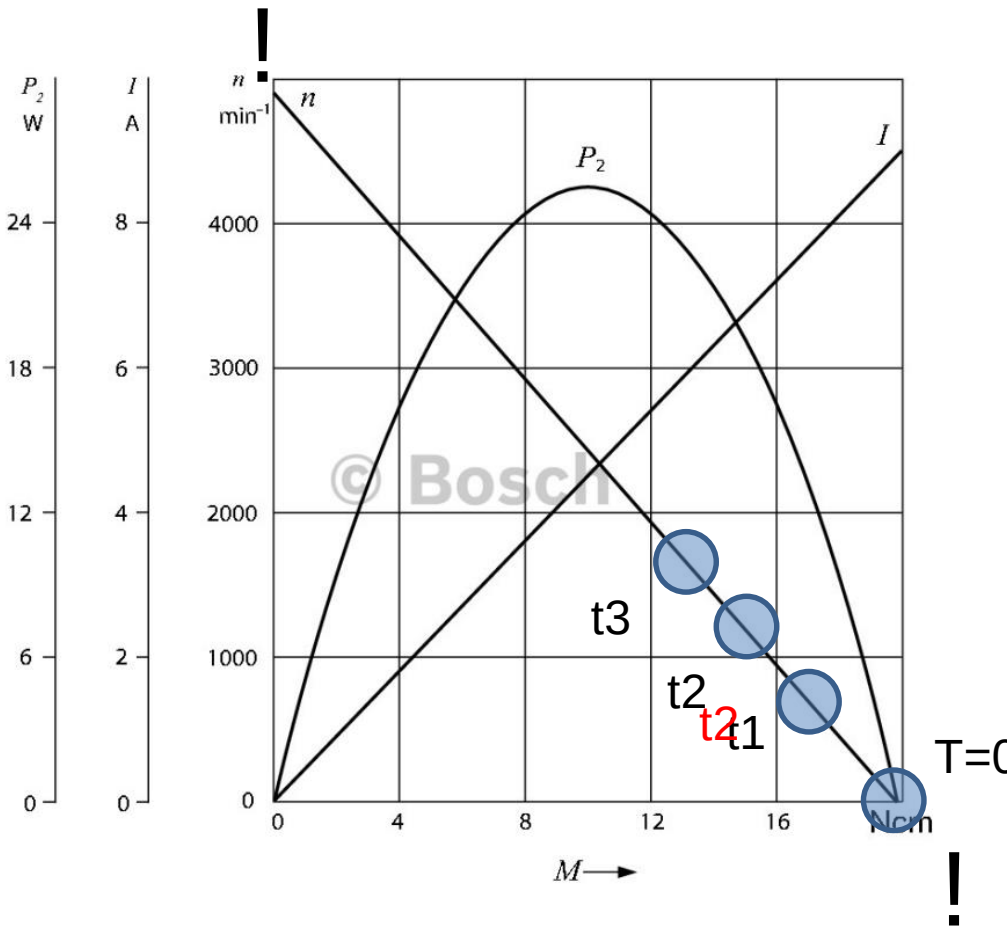
- The motor torque will vary through time because the mechanism is being accelerated



Notes on the Motor

- Not focusing on the control system
- Imagine it switching on and running along the torque/speed line
- The motor torque will vary through time because the mechanism is being accelerated
- Want to maintain the motor within its operating window



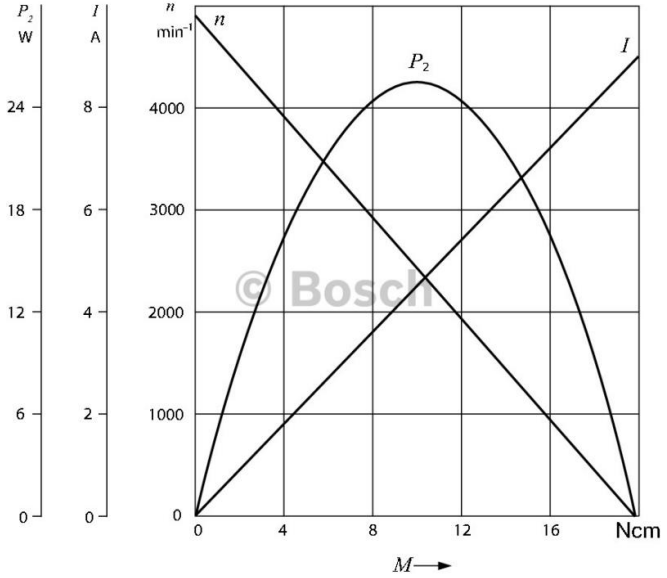
Damping

Linear Dampers

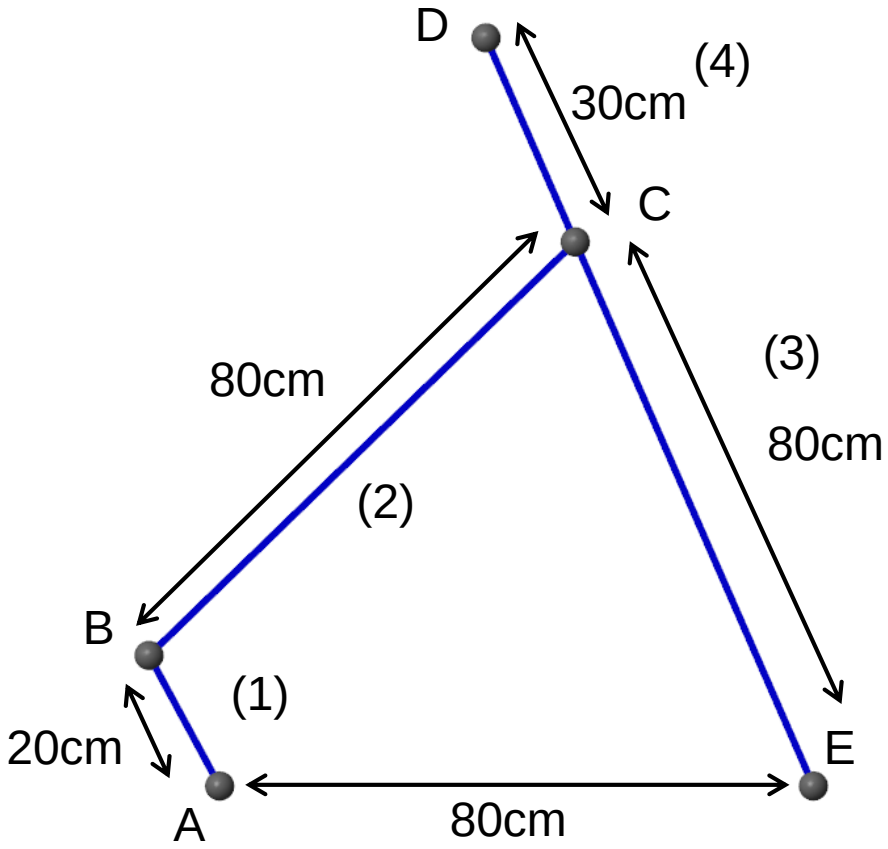
Rotational Dampers

Provide a smooth motion

- Prevent people trapping their fingers
- Safety if an element breaks
- Motor over-speeding



Demo: Four-Bar Mechanism



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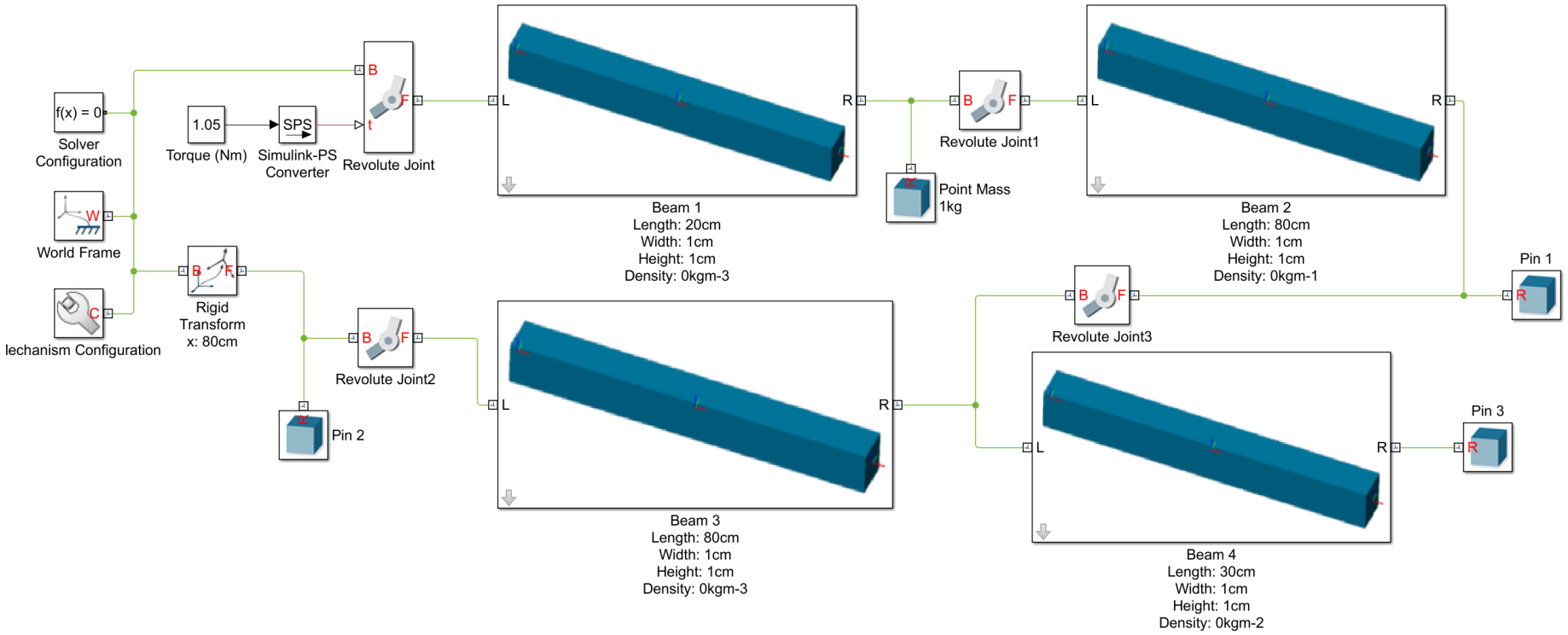
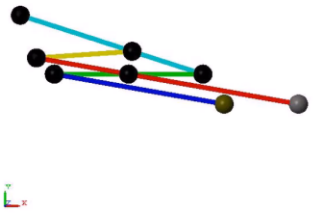
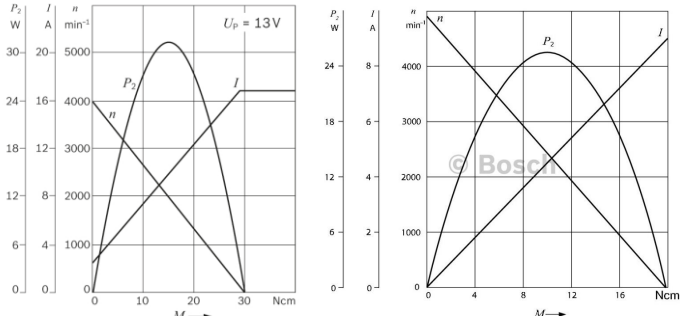


Building Your Mechanism Model

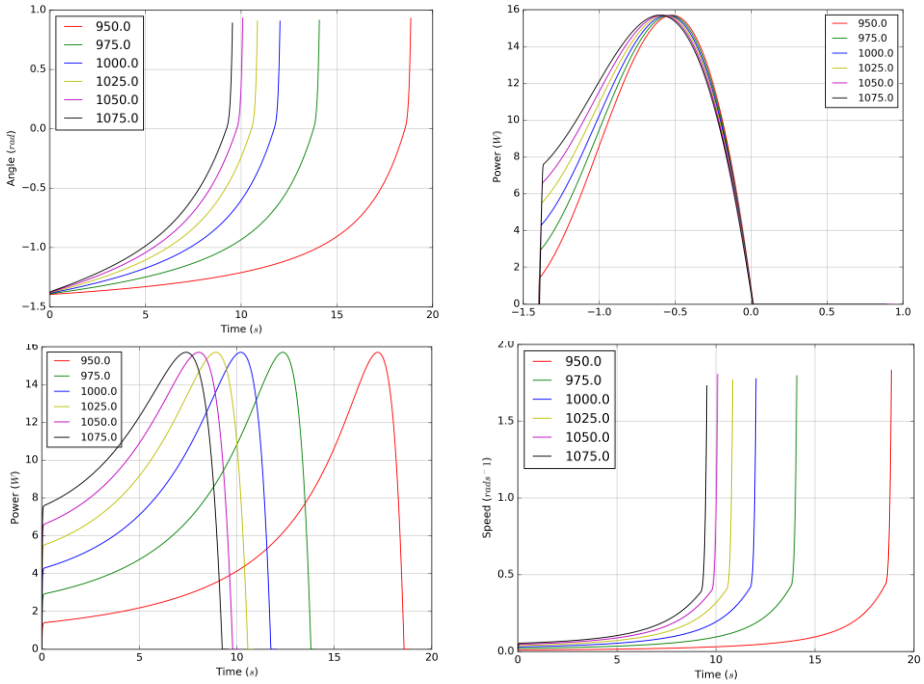
1. Build pendulum model powered by a motor & gearbox
2. Build a separate multi-bar mechanism of your model
3. Combine the two
4. Add damping to prevent the motor over-speeding
   - Otherwise place an IF statement to represent ‘disconnecting the motor’ from the mechanism at higher speeds



Why are we doing this again?



- To investigate various motor and gearbox ratio combinations
- Evaluate the energy required by the system to deploy
- Determine the damping required to keep the motor within its operating window



This Week

- Model the Pendulum with the Motor & Gearbox
- Model of your mechanism
- Combined Model
- Evaluated a number of motor, gear ratios and levels of damping

This afternoons lecture – Gearbox Design

1. Types of Gear
2. Gear Definitions
3. Gear Forces
4. Multi-Stage Gearbox Example
5. Gearbox Design Report Section
6. This Weeks Task