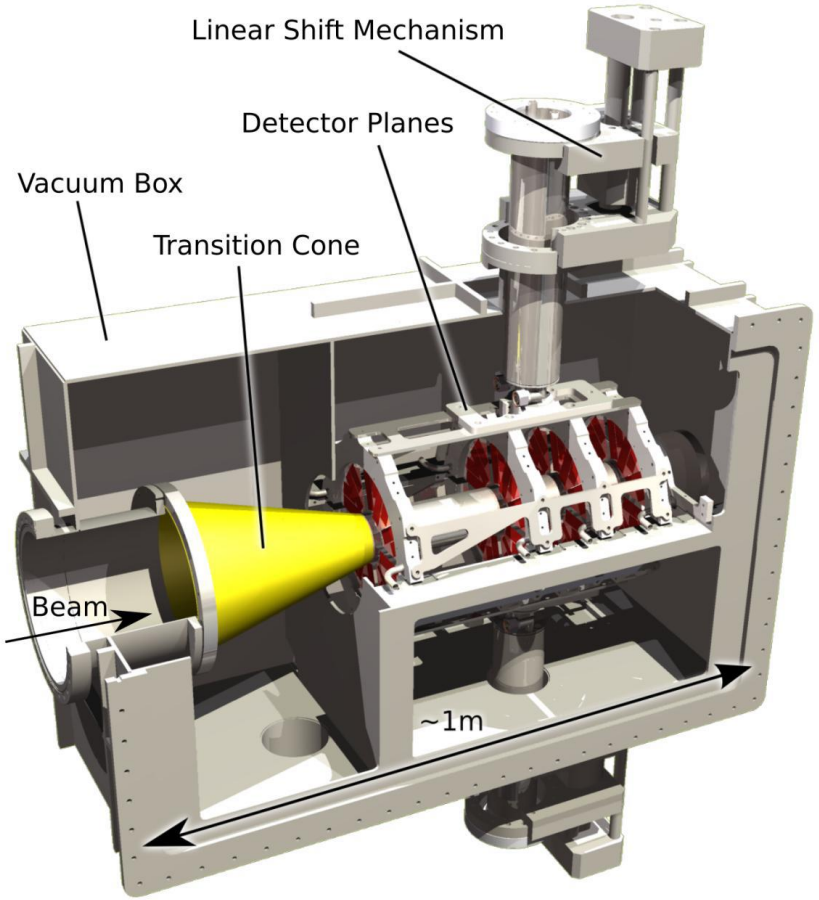

RUHR-UNIVERSITÄT BOCHUM

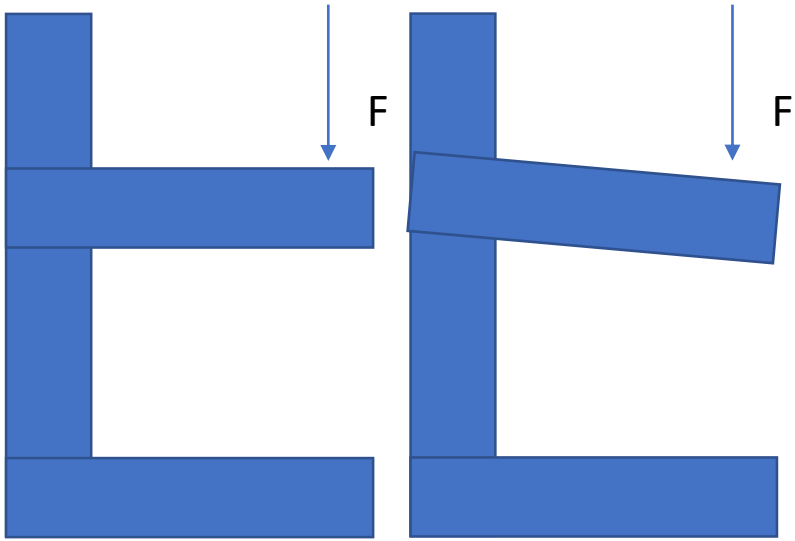
# LINEAR SHIFT MECHANISM

An attemp on simulation-based control-system-design in order to implement a suitable driver-solution into the Lumi-LSM-Set-Up

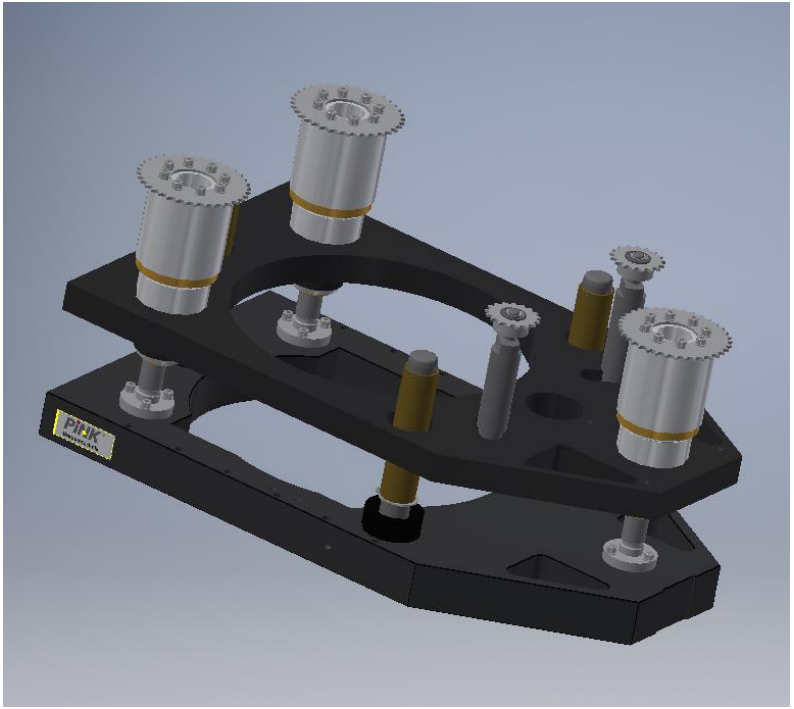

Linear Shift Mechanism
Detector Planes
Vacuum Box
Transition Cone
Beam
~1m

# PROBLEM WITH THE OLD SET-UP

$$M = \Sigma F * l$$



# IMPROVEMENT



- Reuse from HERA
- Three threaded rods
- One motor driving via conveyor-chain
- No more pitch
- Higher stability against vibration and environmental influences

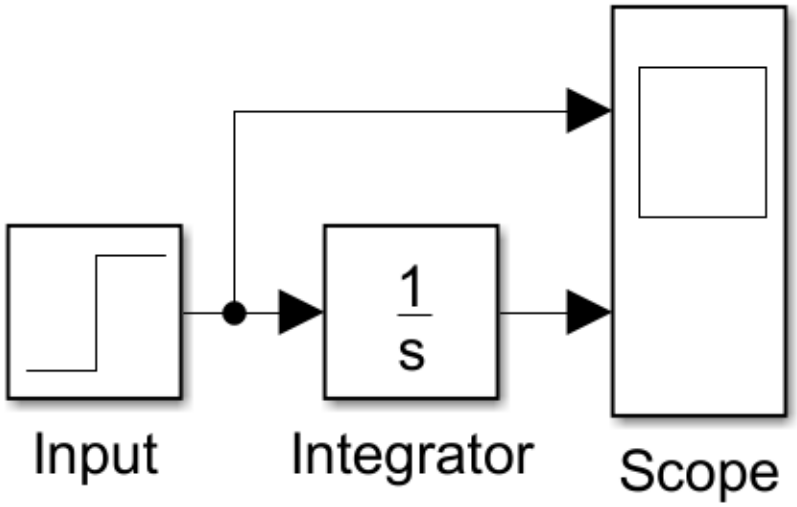
# SIMULATION-BASED-CONTROL-SYSTEM-DESIGN

A **control system** manages, commands, directs, or regulates the behavior of other (…) systems using control loops. It can range from a single home heating controller (…) to large Industrial control systems which are used for controlling (…) machines.

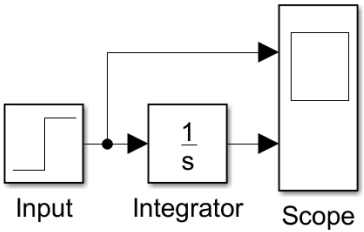
www.wikipedia.com/control_system

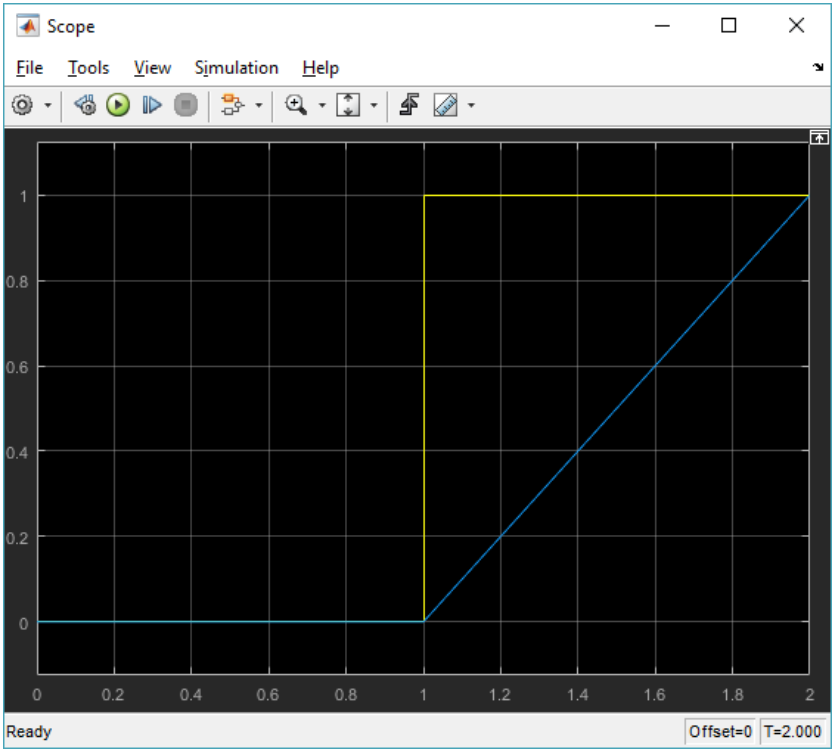
# THE **PROBLEM**

# REGULATION

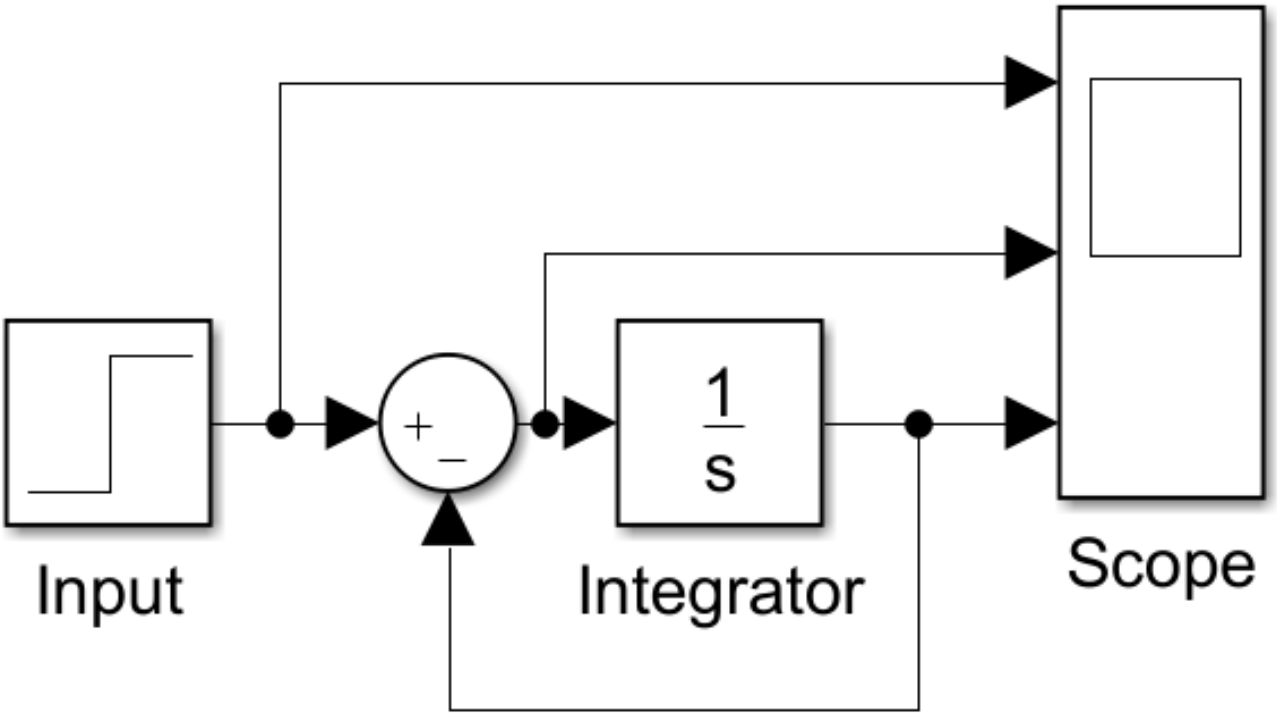


# REGULATION


1
s
Input
Integrator
Scope


Scope
File Tools View Simulation Help
1
0.8
0.6
0.4
0.2
0
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2
Ready
Offset=0
T=2.000

# ADDING A FEEDBACK-LOOP



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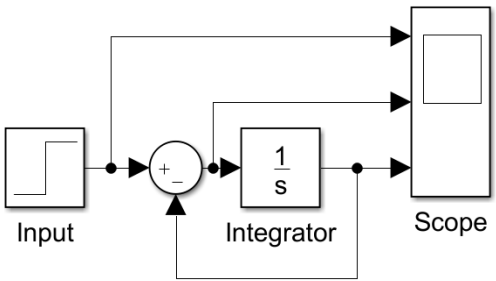
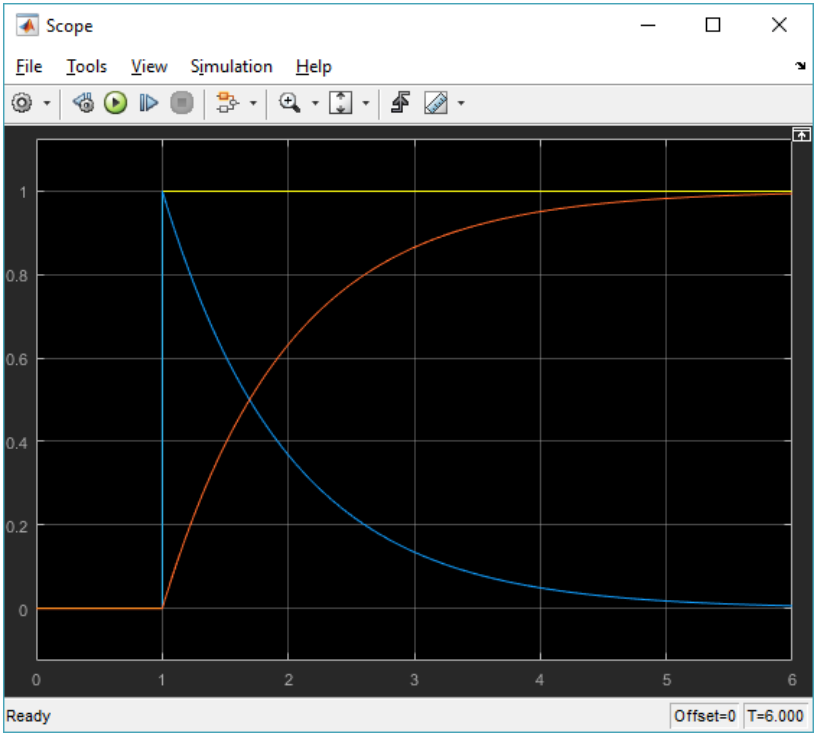
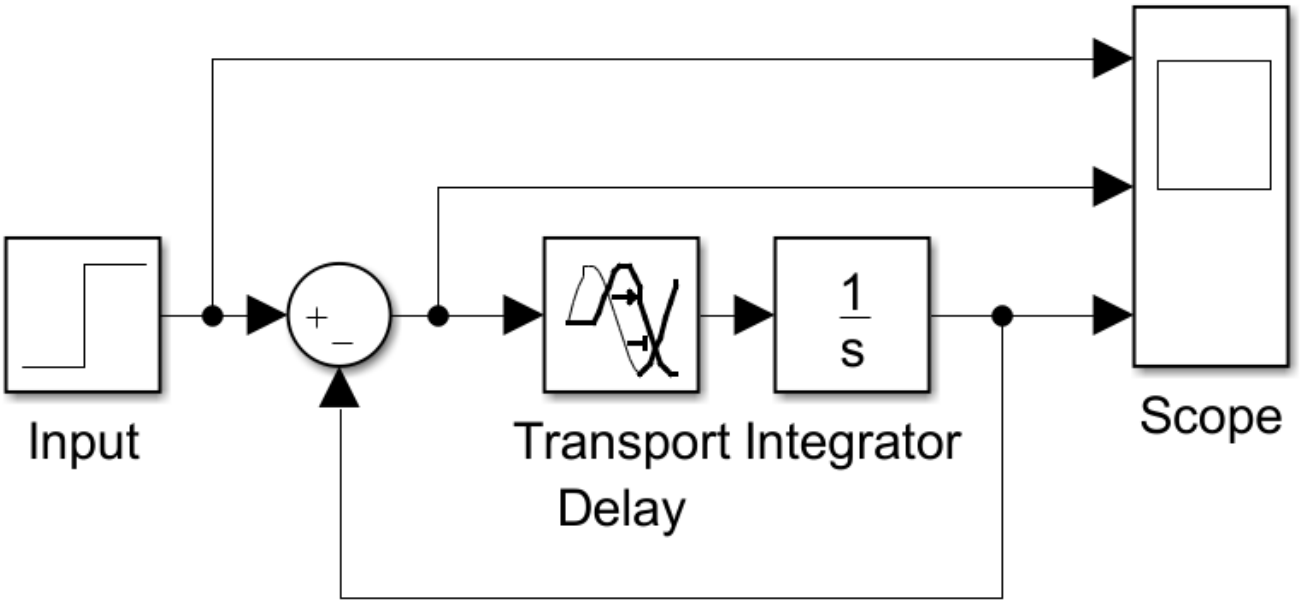


# MECHANICAL SLACKNESS



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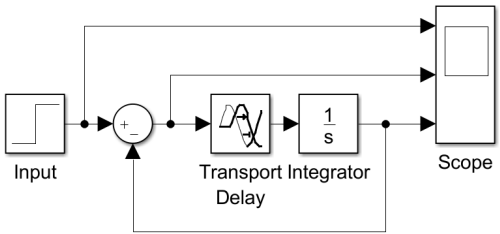
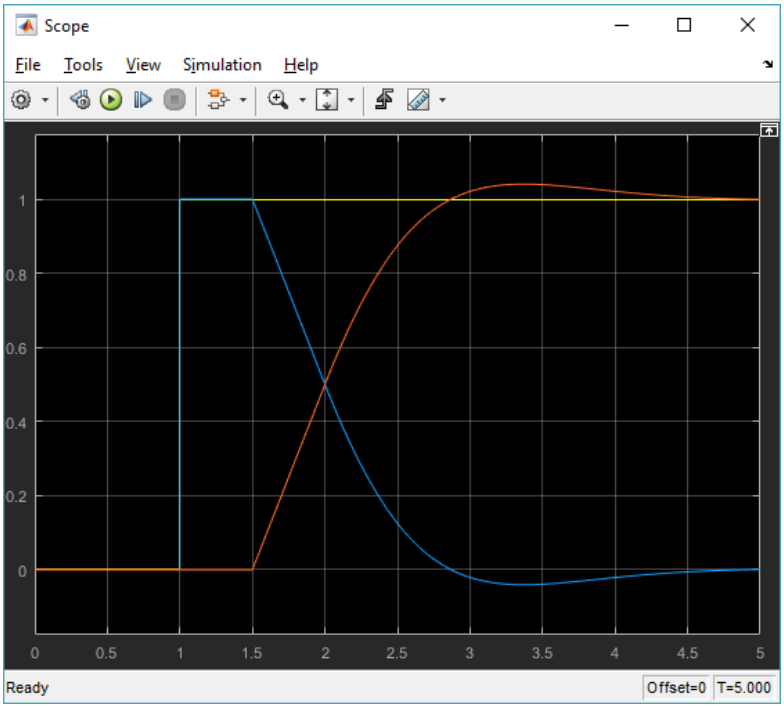
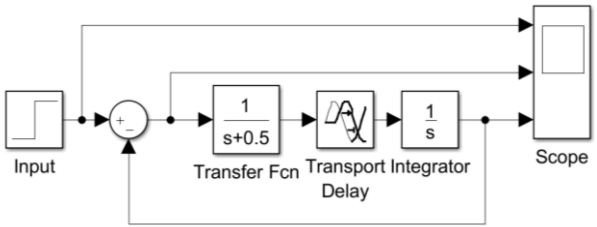
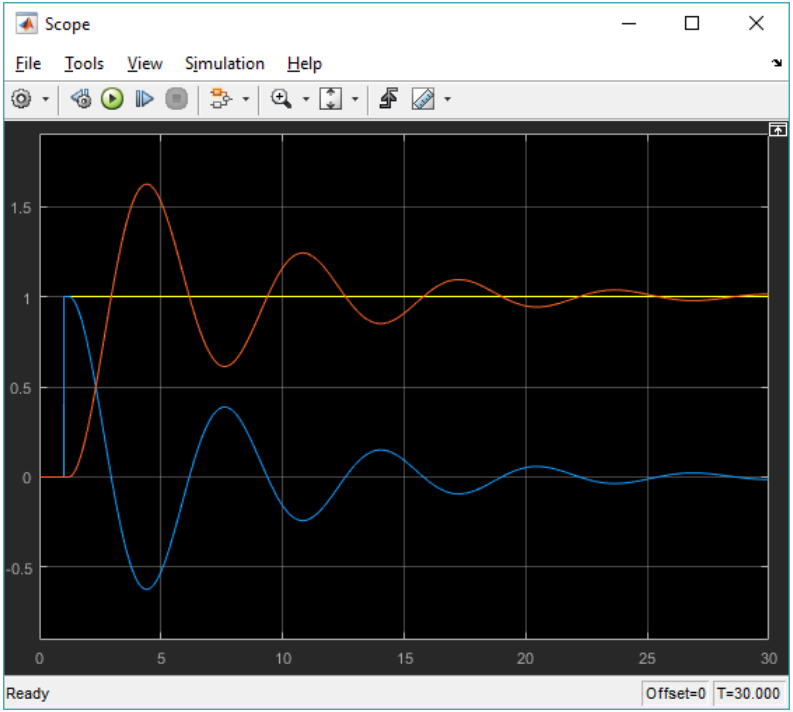


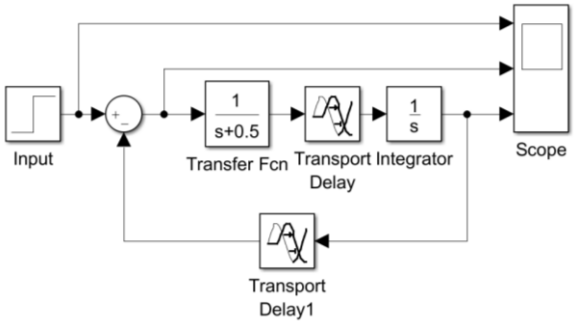



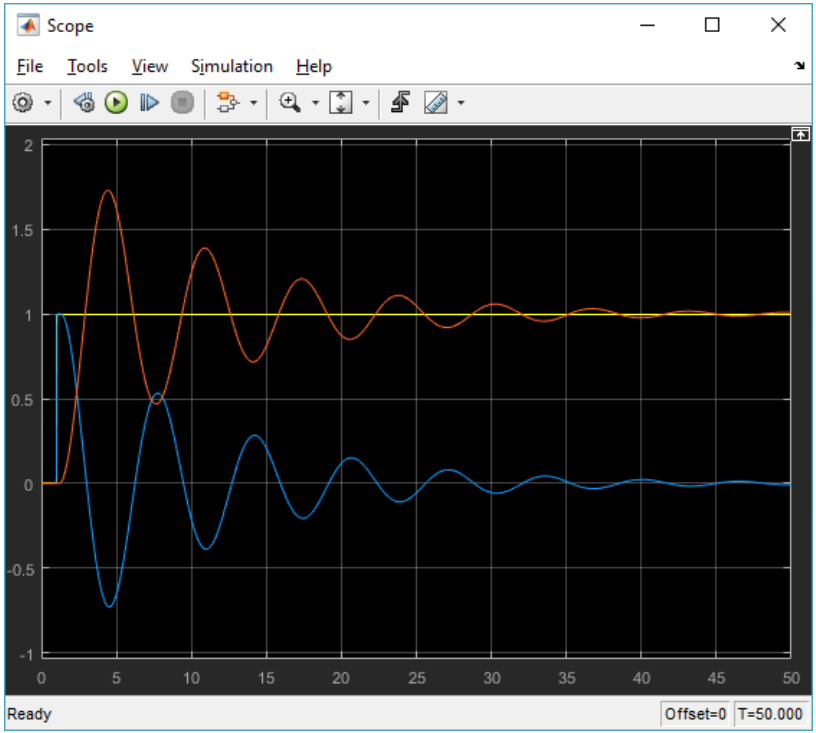
# ELASTICS AND INERTIA



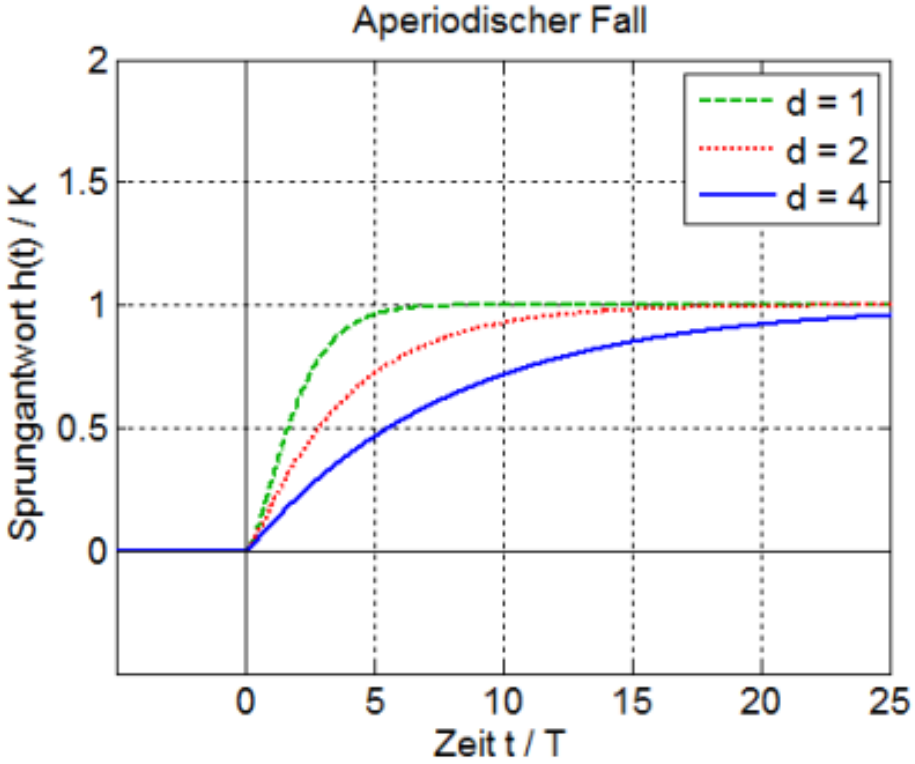



# NON-IDEAL FEEDBACK-LOOP



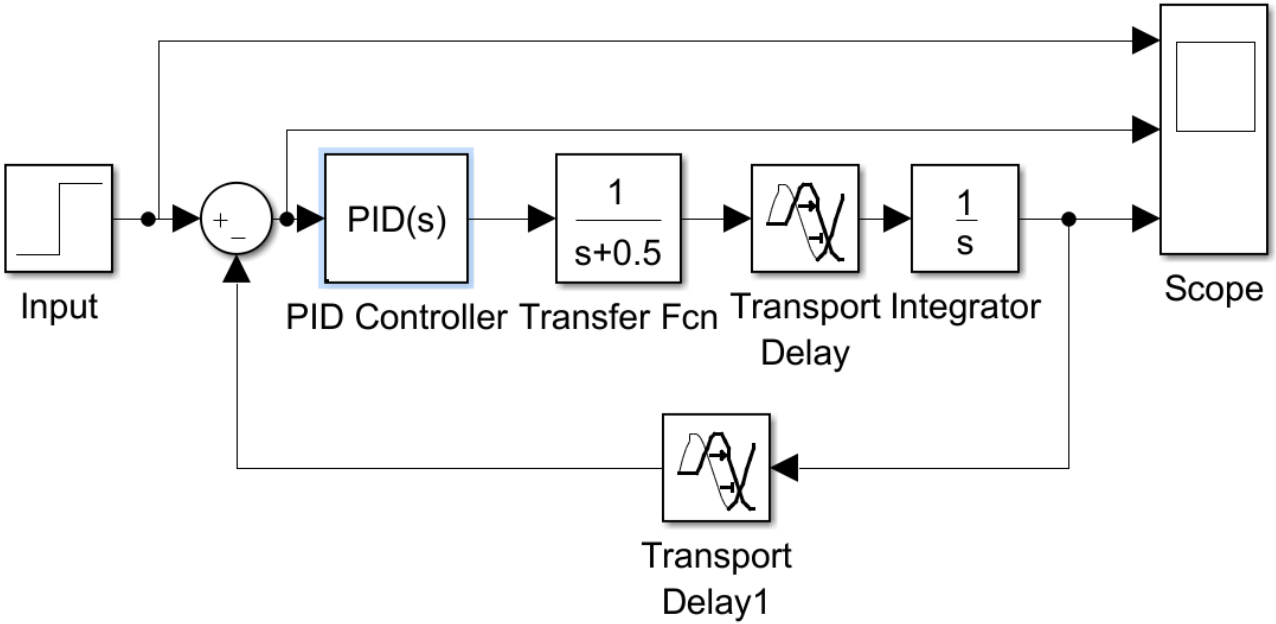



# WHAT AM I SEARCHING FOR

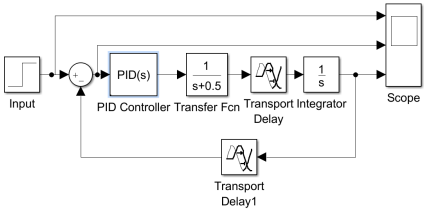


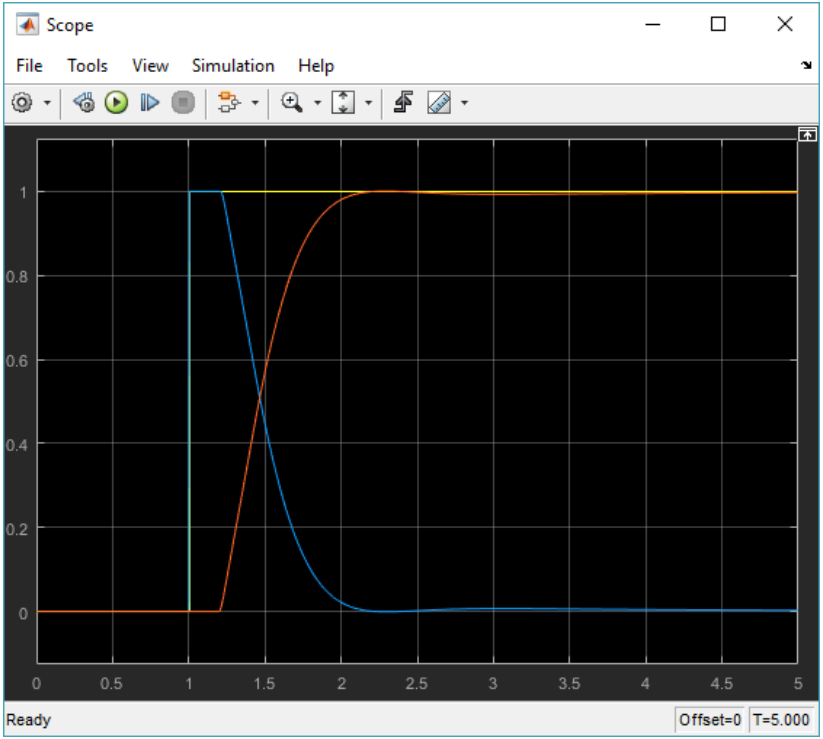
# THE **SOLUTION**

# CONTROLLER

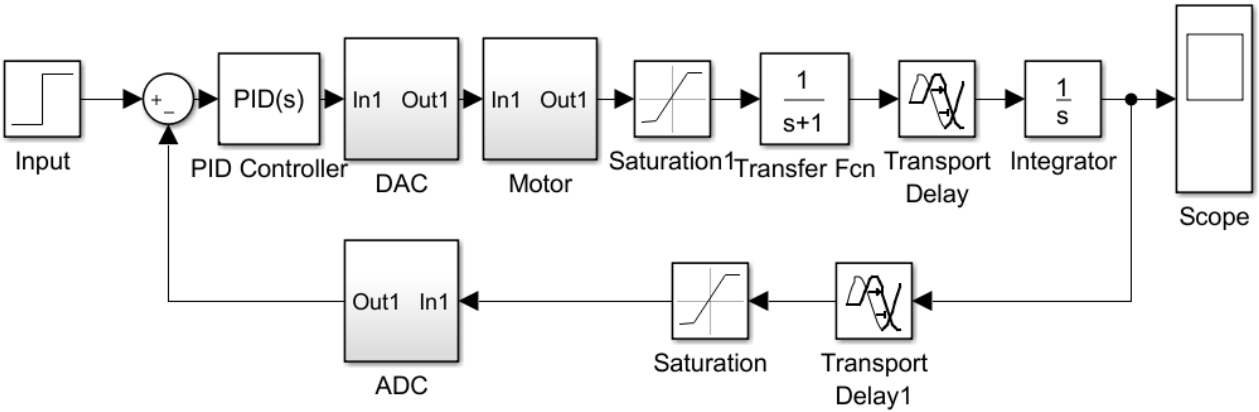

Input
+
_
PID(s)
PID Controller
1
s+0.5
Transfer Fcn
Transport
Delay
1
s
Integrator
Scope
Transport
Delay1

# CONTROLLER


Input
PID(s)
PID Controller
1
s+0.5
Transfer Fcn
Transport Delay
1
s
Integrator
Scope
Transport Delay1


Scope
File
Tools
View
Simulation
Help
1
0.8
0.6
0.4
0.2
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Ready
Offset=0
T=5.000

# BAD, WORSE, REALITY



# STEP TO A MODEL-BASED-SIMULATION

- Have a precise CAD-drawing
- Identify all dampenings, delays, elastics and inertias in the system
- Pick a suitable motor and make a SIMULINK model
- Synthesise a suitable control algorithm and and compile it to SIMULINK
- Test the model and optimize the control-algorithm

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ITERATE

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