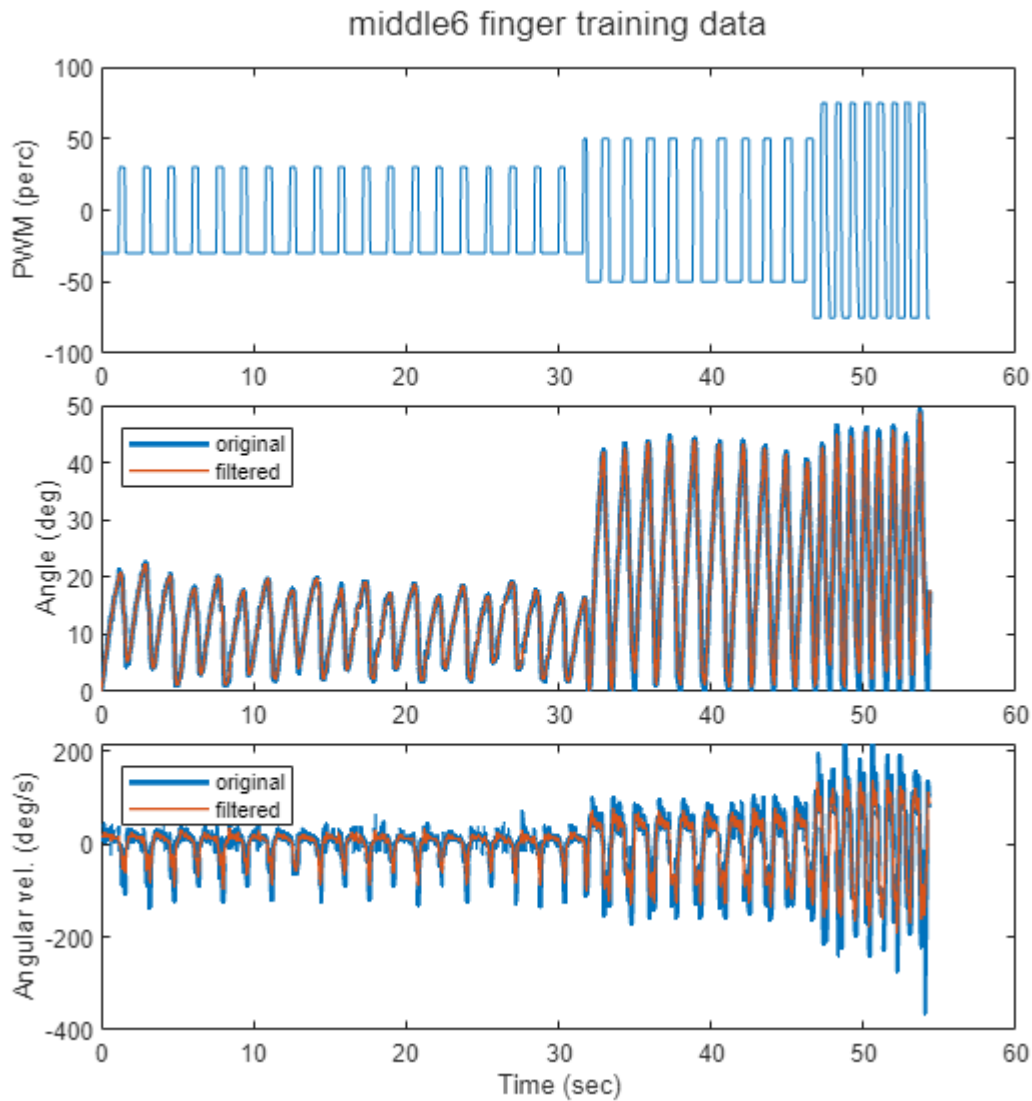


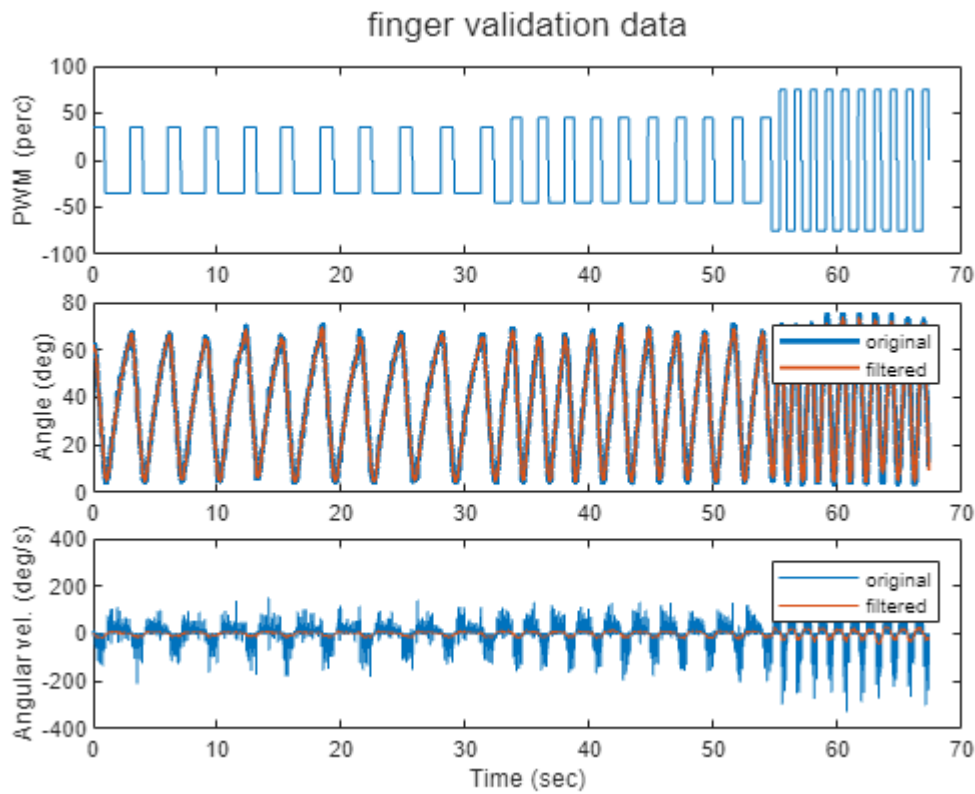
# ergoCub Finger PID tuning

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## Read and plot datasets





## Run identification as process model

We target a continuous LTI model in the form

$$\frac{y}{u} = \frac{k(s - z_1)}{(s - p_1)(s - p_2)}$$

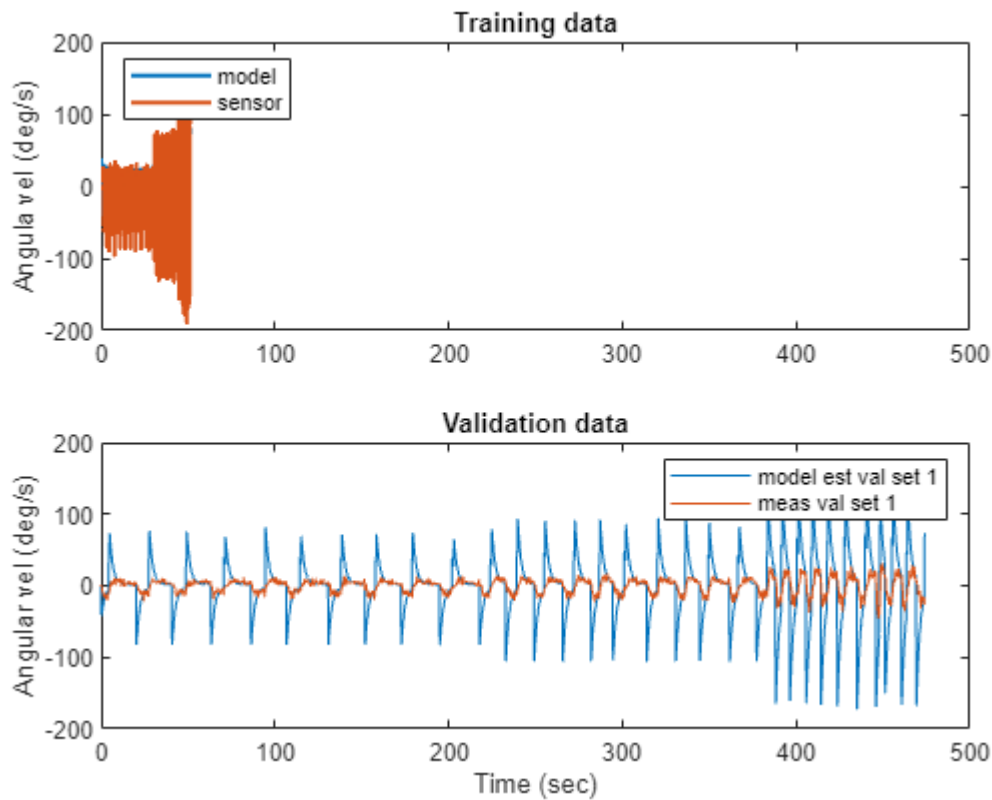
The poles can be real or complex conjugate.

ans =

```
From input "u1" to output "y1":
-22.728 (s+0.01721)
-----
(s+16.95) (s+0.5272)
```

Continuous-time zero/pole/gain model.  
Model Properties

Plot results.



```
name: "Validation set 1 result"
value: 40.9043
```

## Add integrator for position control

We change the IO relationship from  $\frac{\dot{\theta}}{u}$  to  $\frac{\theta}{u}$  since we want to control the finger position.

## Run autotuning

Here we define the specifications to tune the position controller in a robust way, and run the tuning algorithm.

### Define tuning goals

Define the desired specifications.

```
option 3 - custom
Ts:0.05, responsetime:0.5, derror:0.005, peakerror:1.1, Overshoot:20
```

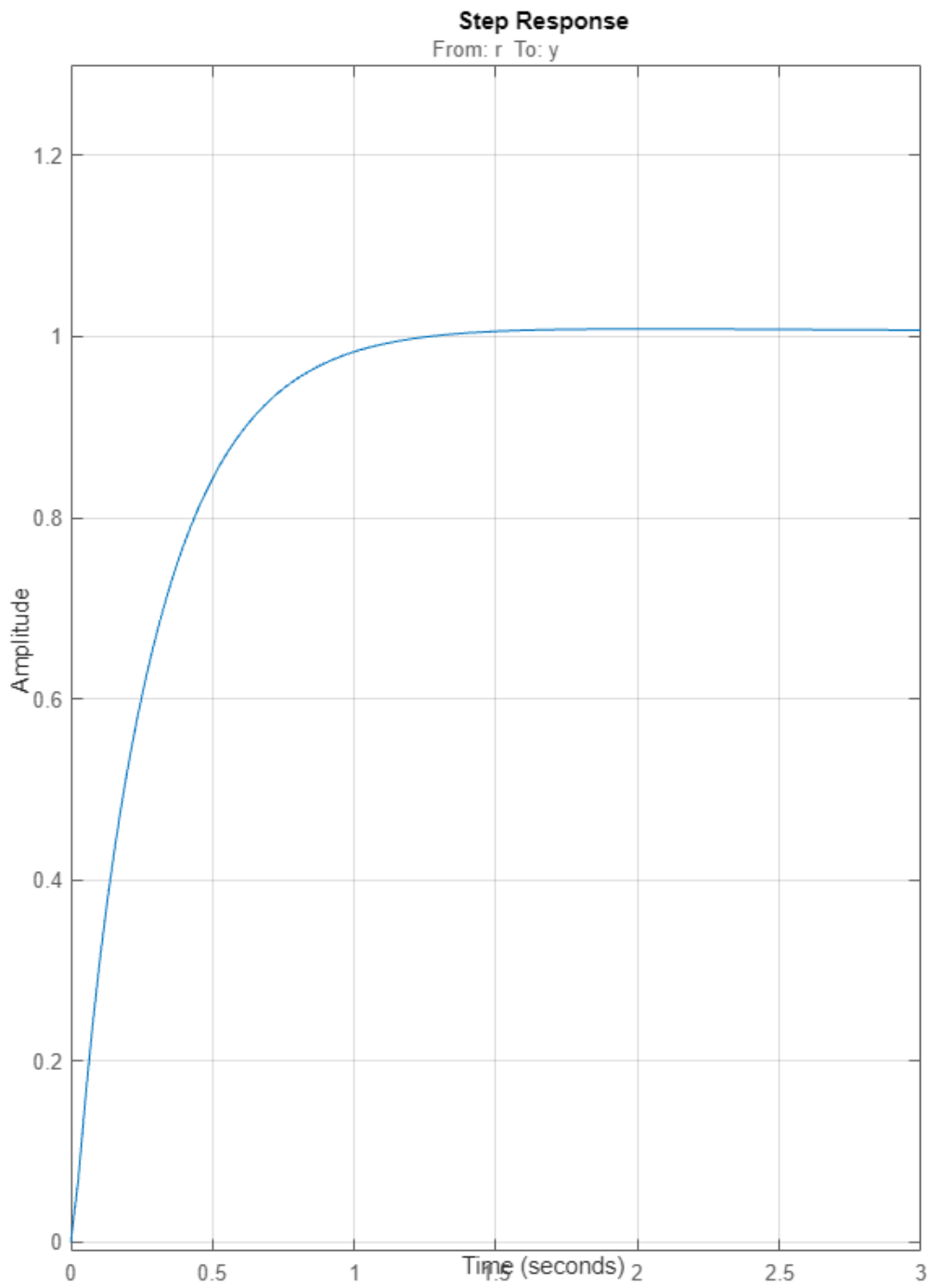
Define the goals.

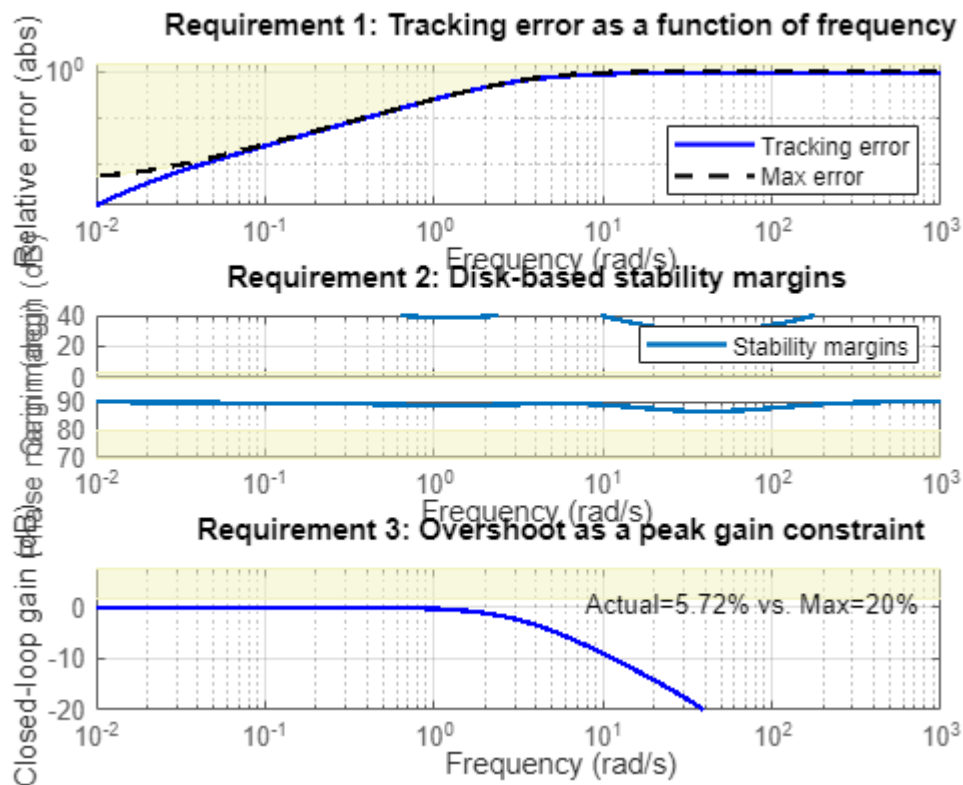
```
hard_goals: tracking
soft_goals: margin, overshoot
```

## Tune up the controller

Tune a PI controller. The D is zero since the system is highly damped due to friction.

Plot tuning results.





Get the discretized controller.

Cz =

$$K_p + K_i * \frac{T_s(z+1)}{2*(z-1)} + K_d * \frac{1}{T_f + T_s/2*(z+1)/(z-1)}$$

with  $K_p = -2.78$ ,  $K_i = -1.52$ ,  $K_d = -0.159$ ,  $T_f = 0.01$ ,  $T_s = 0.05$

Sample time: 0.05 seconds

Discrete-time PIDF controller in parallel form.

Model Properties

Error using export>checkWritePermission

Unable to overwrite existing file. Check write permission or whether the file is open in another application.

Error in export (line 98)

checkWritePermission(results.Destination);