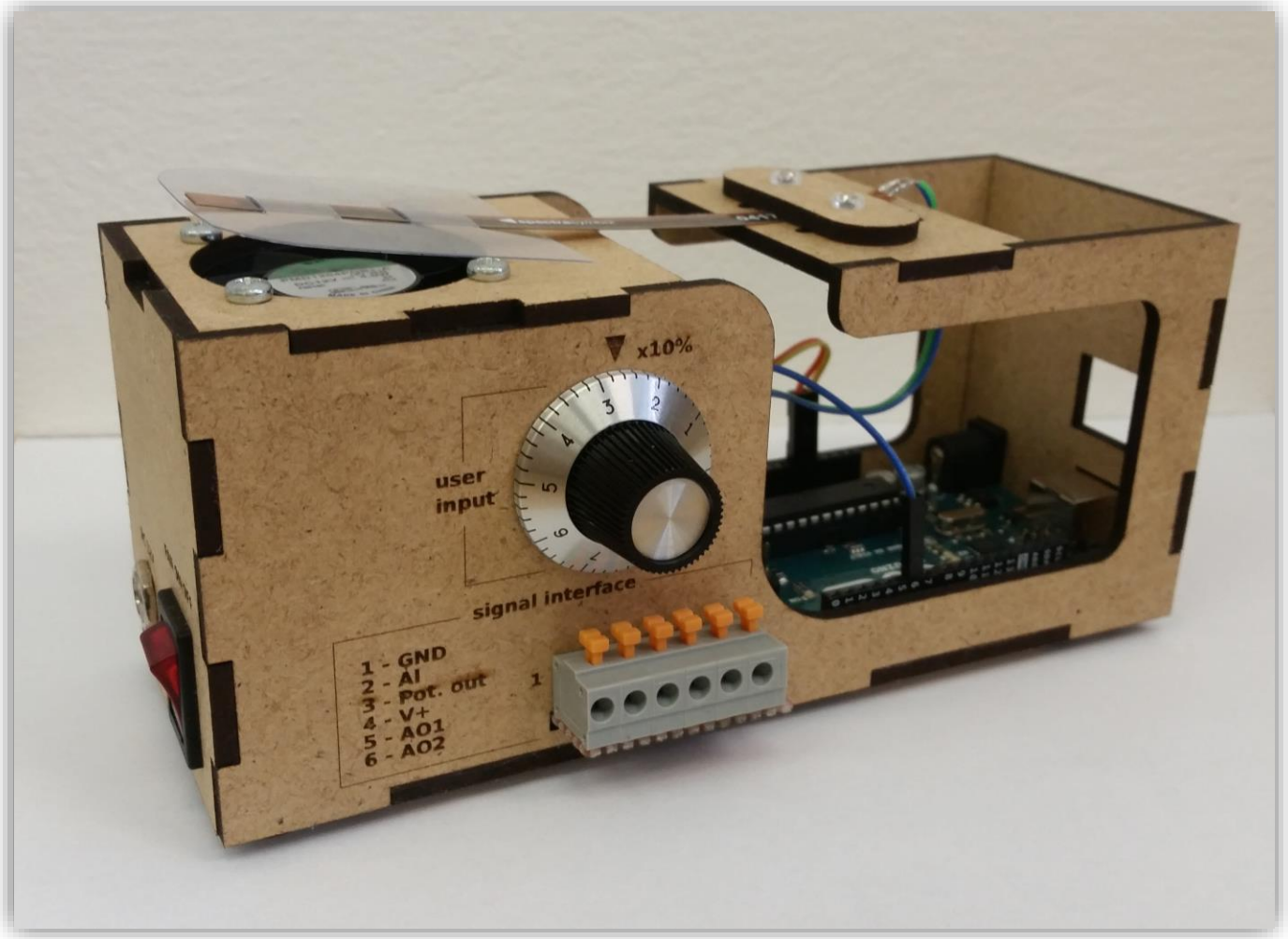
Flexy

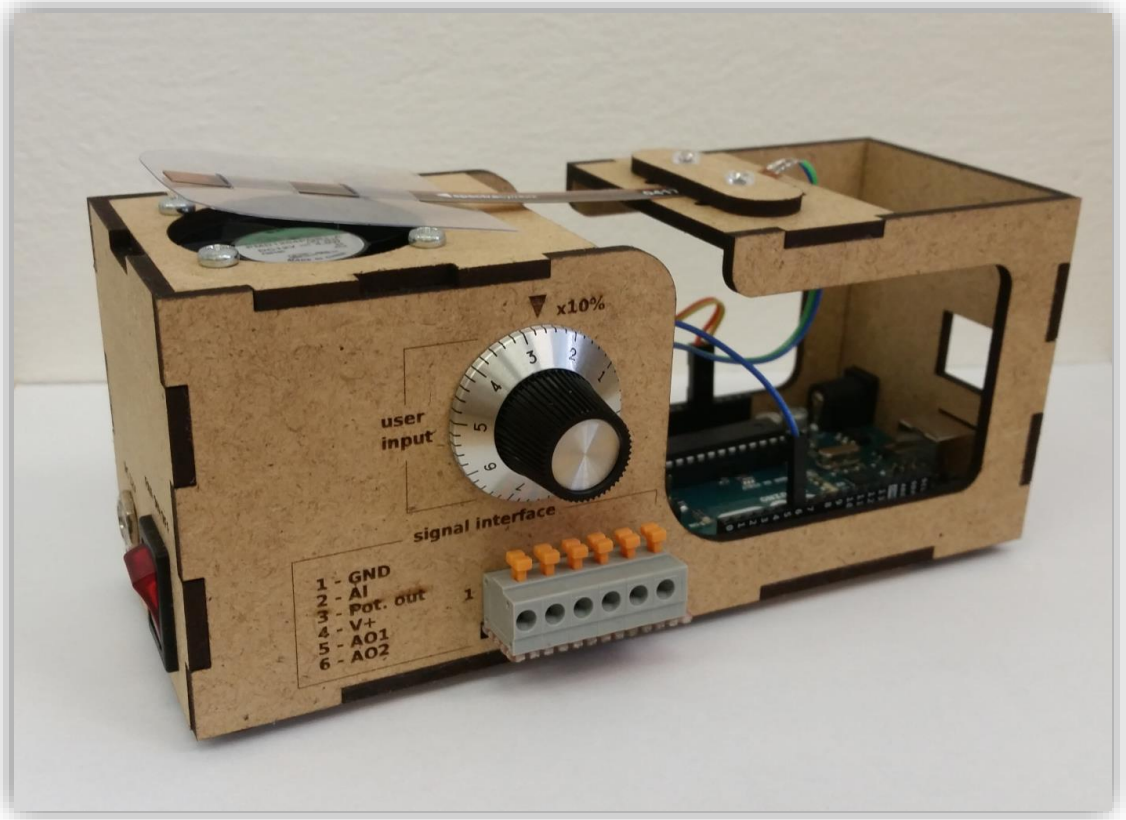


github.com/martin-kaluz/flexy-arduino/wiki

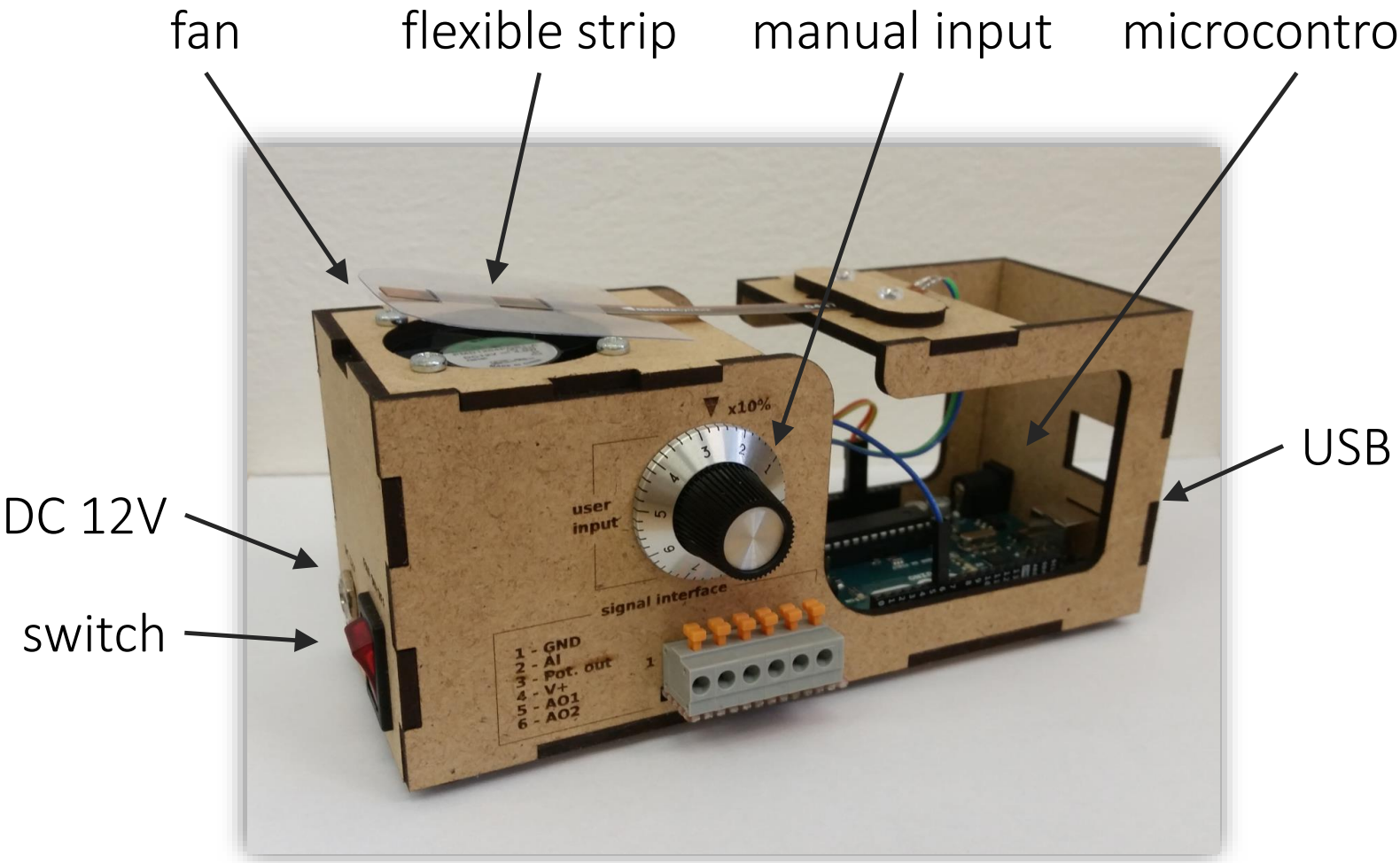
Flexy

– open-source hardware device for process control training and education,
– dynamical system with one actuator (fan) and one sensor (flex resistor),
– system allows to measure and control an air flow produced by fan,
– air flows around an obstacle that is mounted on a flexible strip.

github.com/martin-kaluz/flexy-arduino/wiki

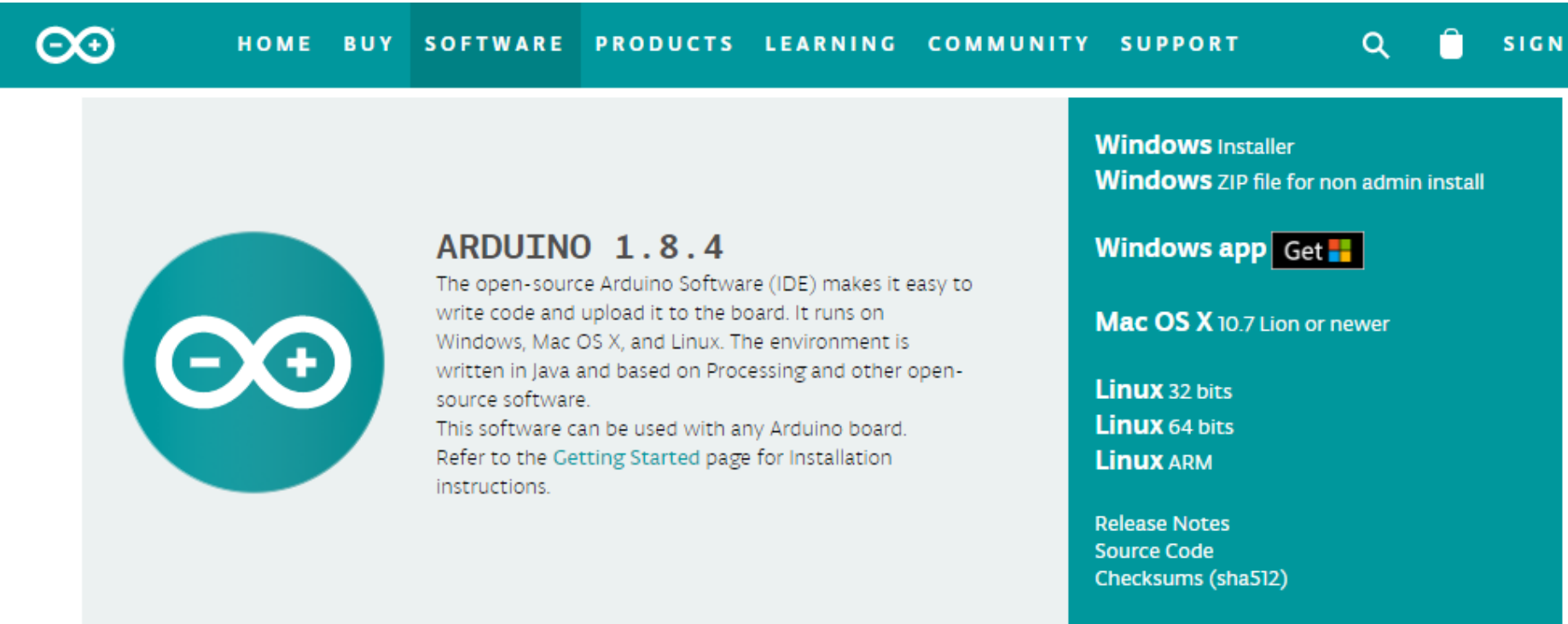


Flexy – Parts


fan
flexible strip
manual input
microcontroller
USB
DC 12V
switch
x10%
user input
signal interface
1 - GND
2 - AI
3 - Pot. out
4 - V+
5 - AO1
6 - AO2

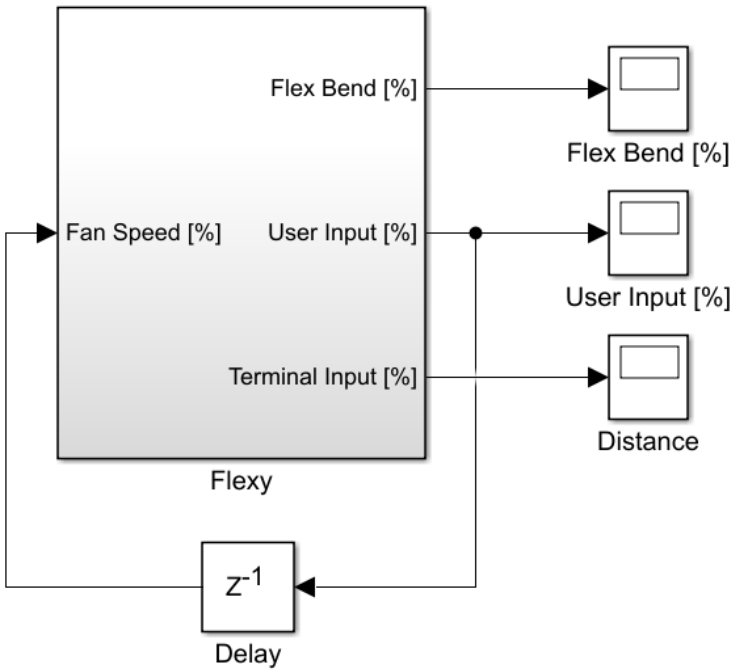
Flexy – Drivers

www.arduino.cc/en/main/software



Flexy – Manual Control

`flexy_model.slx`



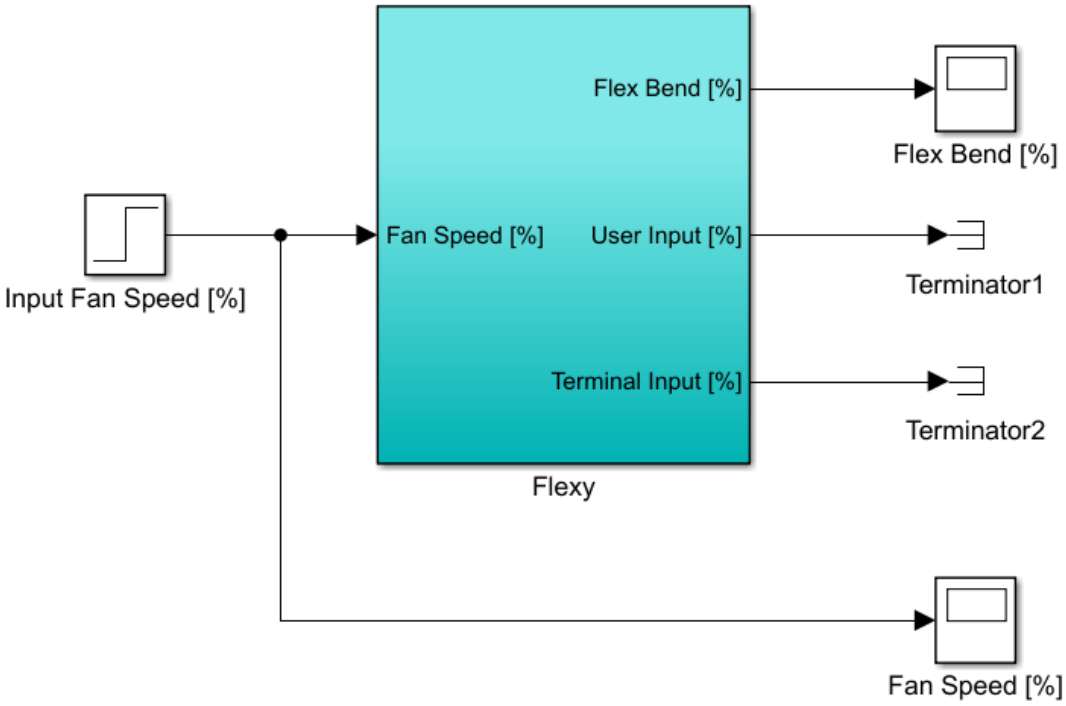
`runme.m`

```
%% prerequisities
addpath('RealTime_Pacer')
slCharacterEncoding('UTF-8')
%% Setup
% define sampling time
Ts = 0.05;
% define COM port address
Port = 'COM4';
% calibration on/off
calibrate = 1;

%% Simulink model
open('flexy_model.slx');
```

Flexy – Identification

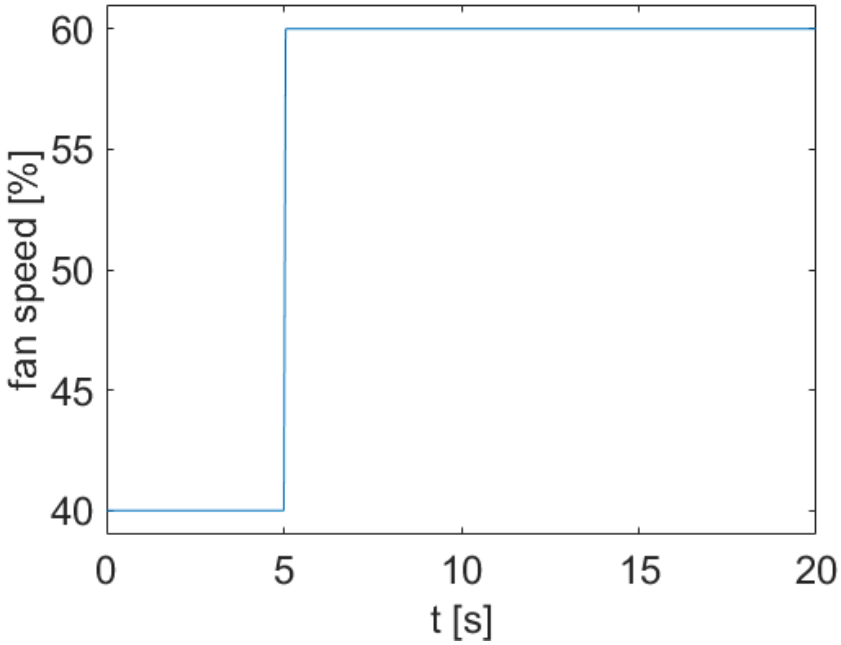
`flexy_identification.slx`

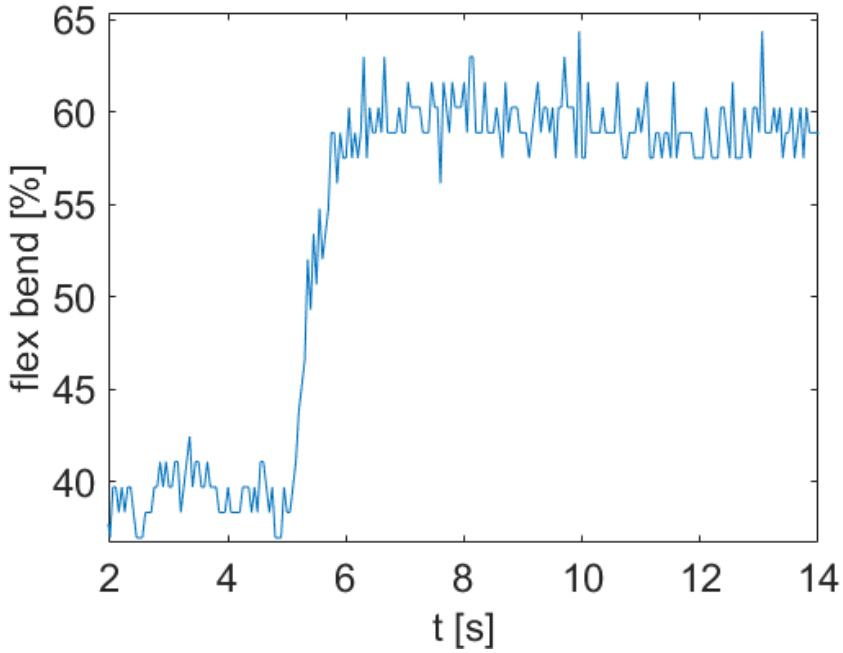


Flexy – Identification

`flexy_identification.slx`

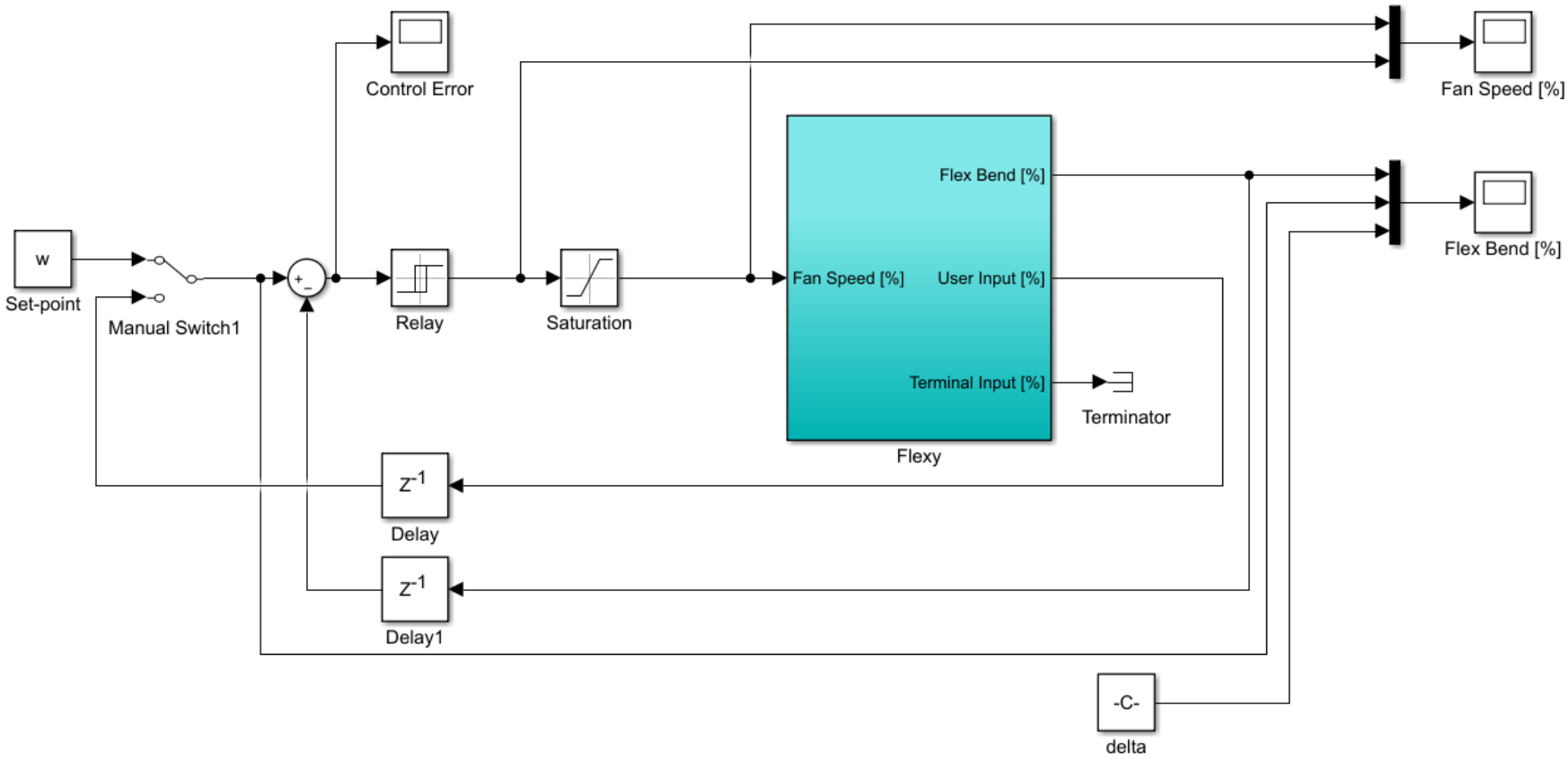
$$G(s) = \frac{1.1}{0.4s+1} e^{-0.01s}$$



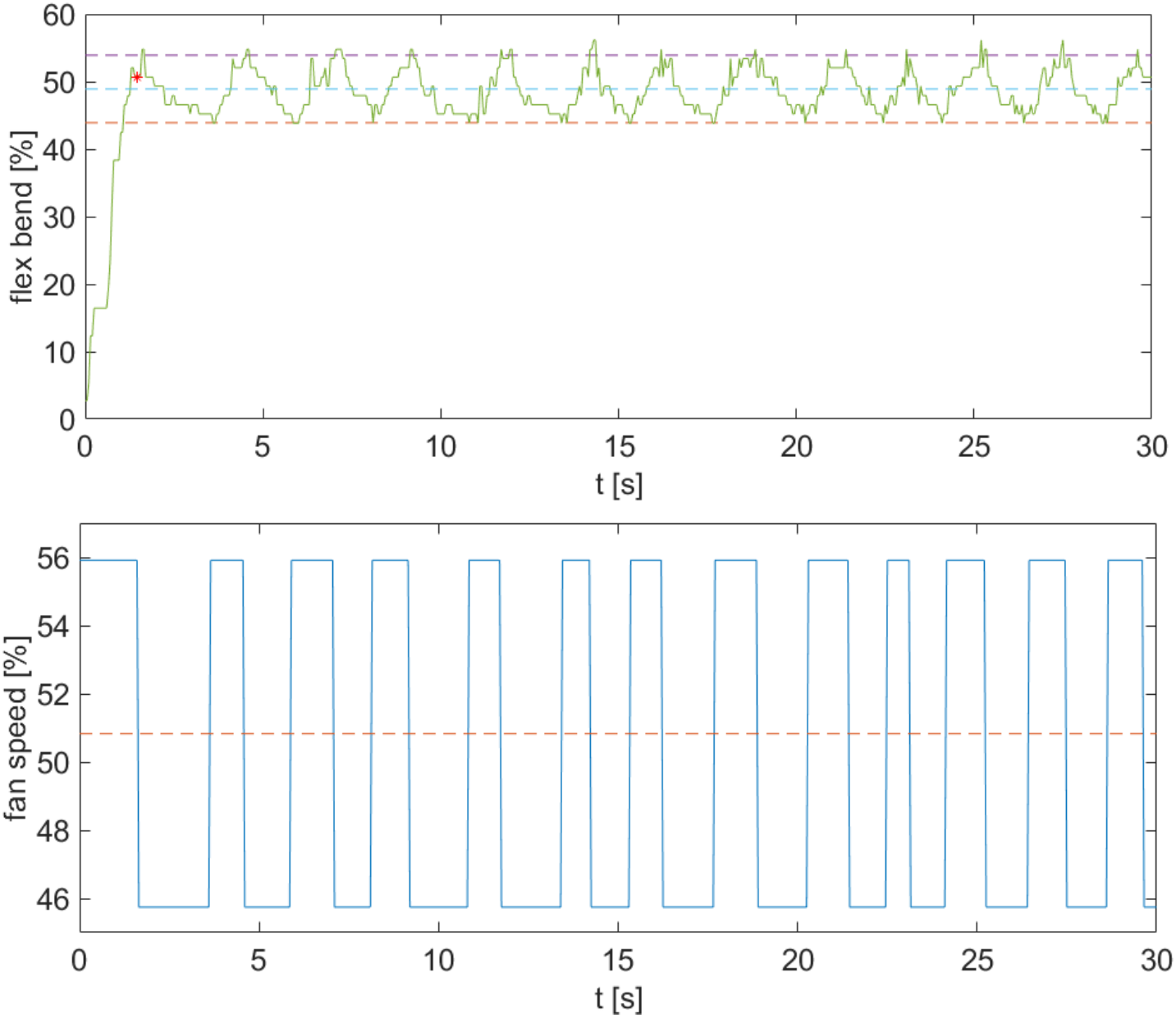


Flexy – Autotuning

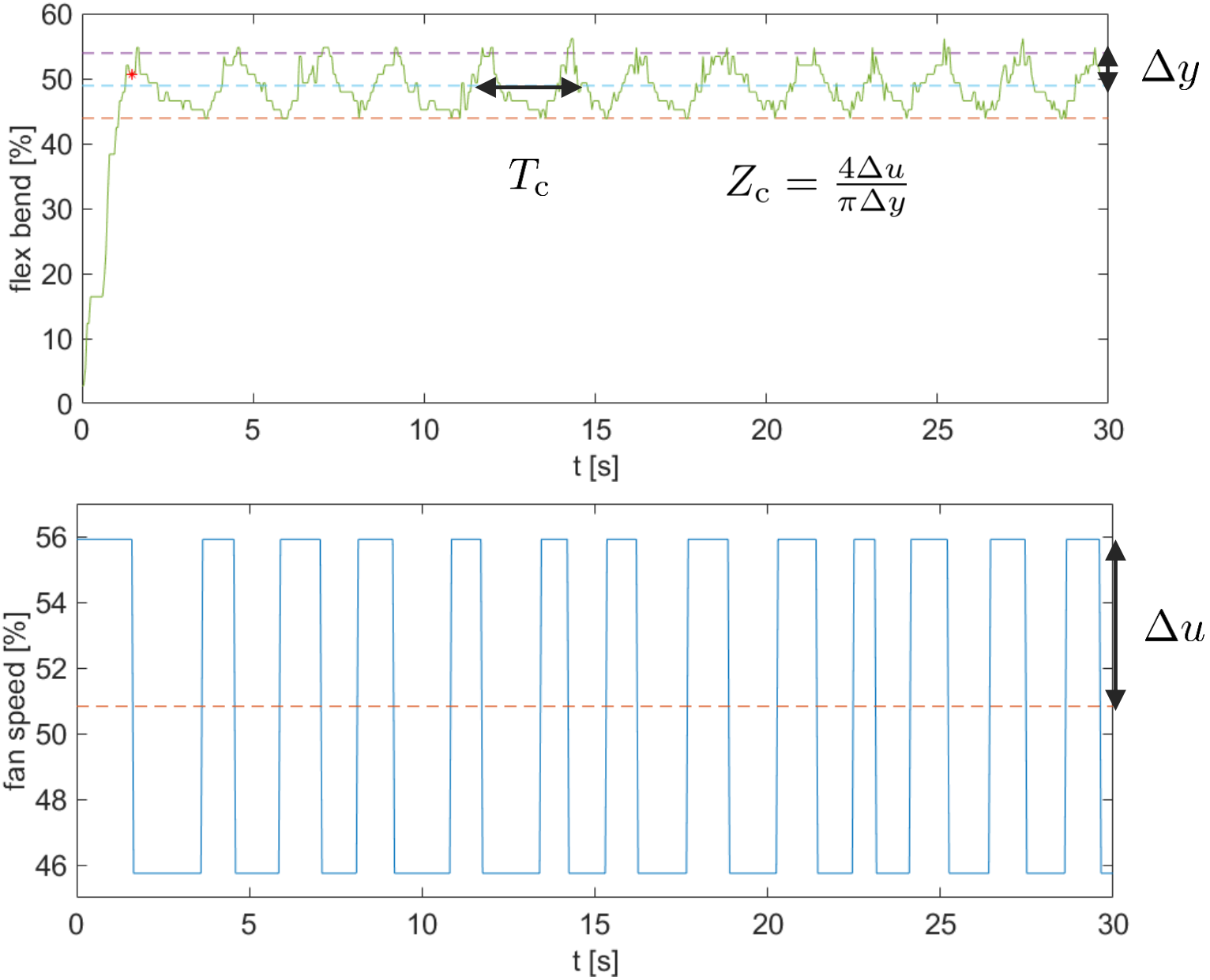
`flexy_autotuning.slx`



Flexy – Autotuning

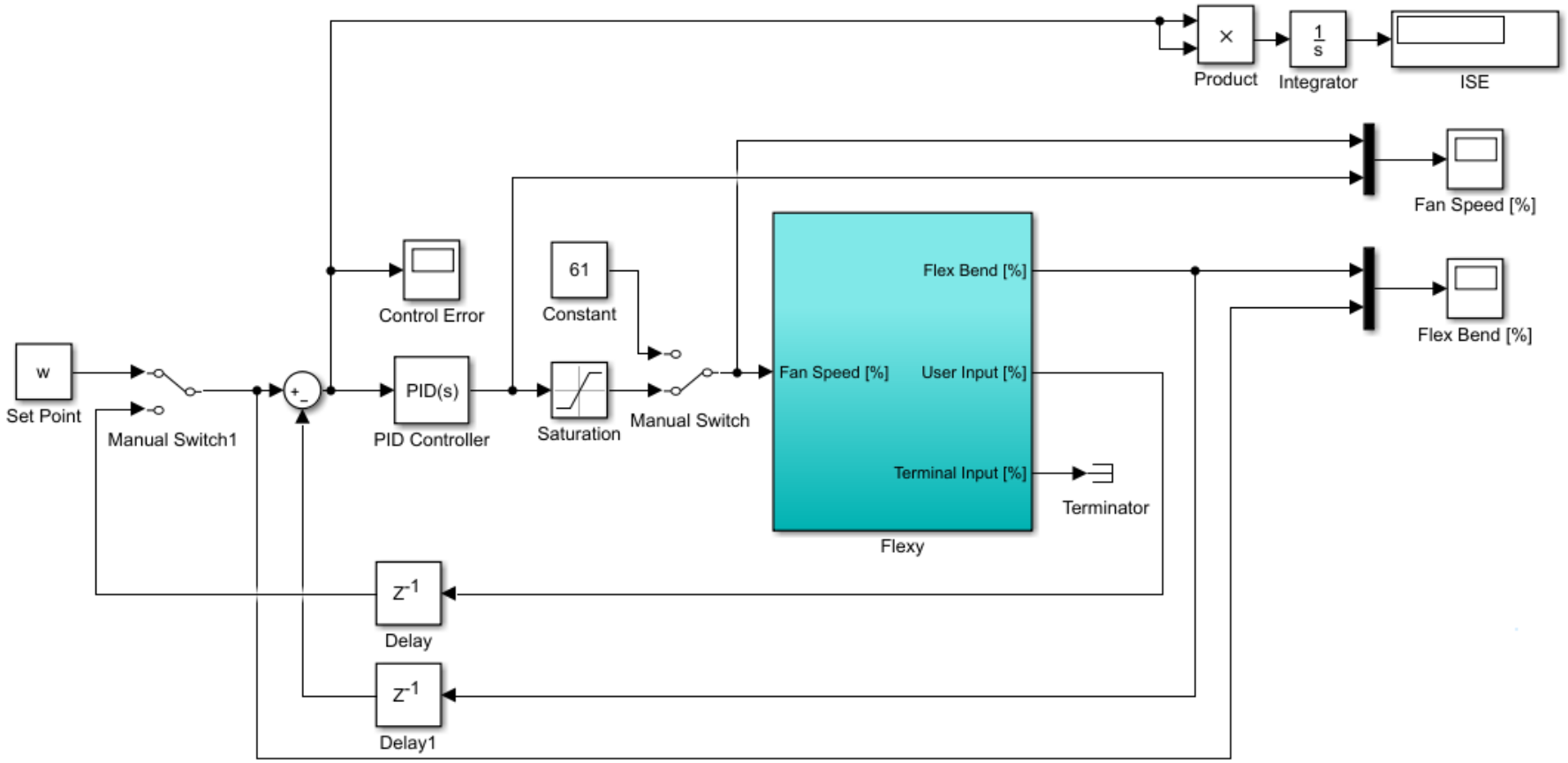


Flexy – Autotuning



Flexy – PID Control

`flexy_pid_control.slx`



Flexy – PID Control

`flexy_pid_control.slx`

Controller	Z_R	T_I	T_D
P	$0.5\,Z_c$	†	†
PI	$0.4\,Z_c$	$0.8\,T_c$	†
PID	$0.6\,Z_c$	$0.5\,T_c$	$0.125\,T_c$
PID - small overshoot	$0.33\,Z_c$	$0.5\,T_c$	$T_c/3$
PID - undershoot	$0.2\,Z_c$	$0.5\,T_c$	$T_c/3$