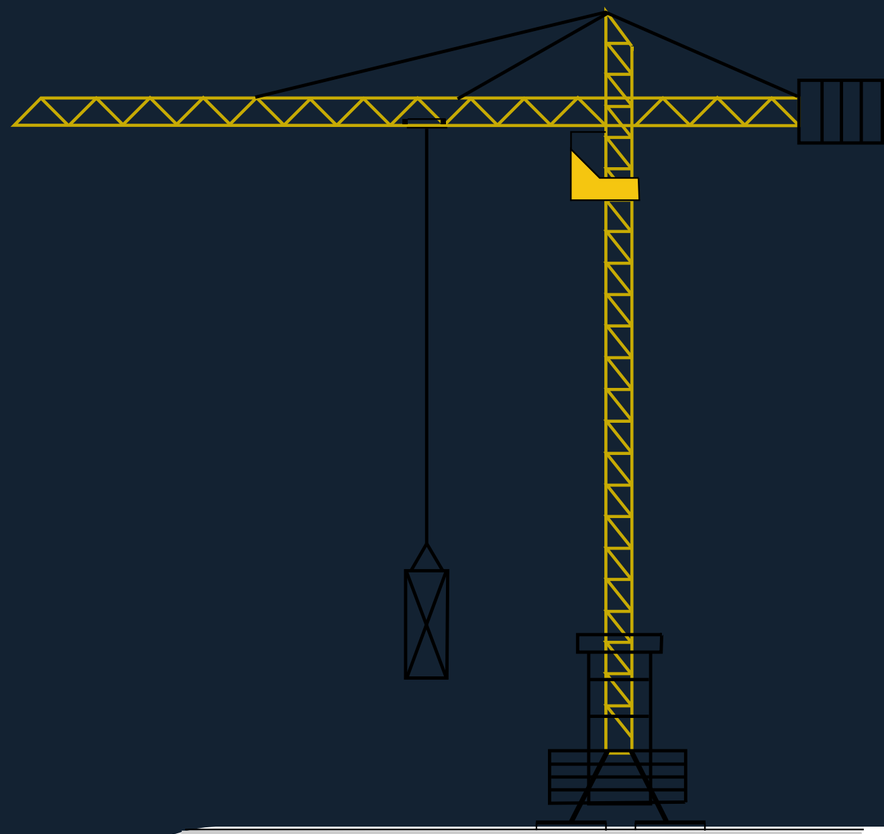
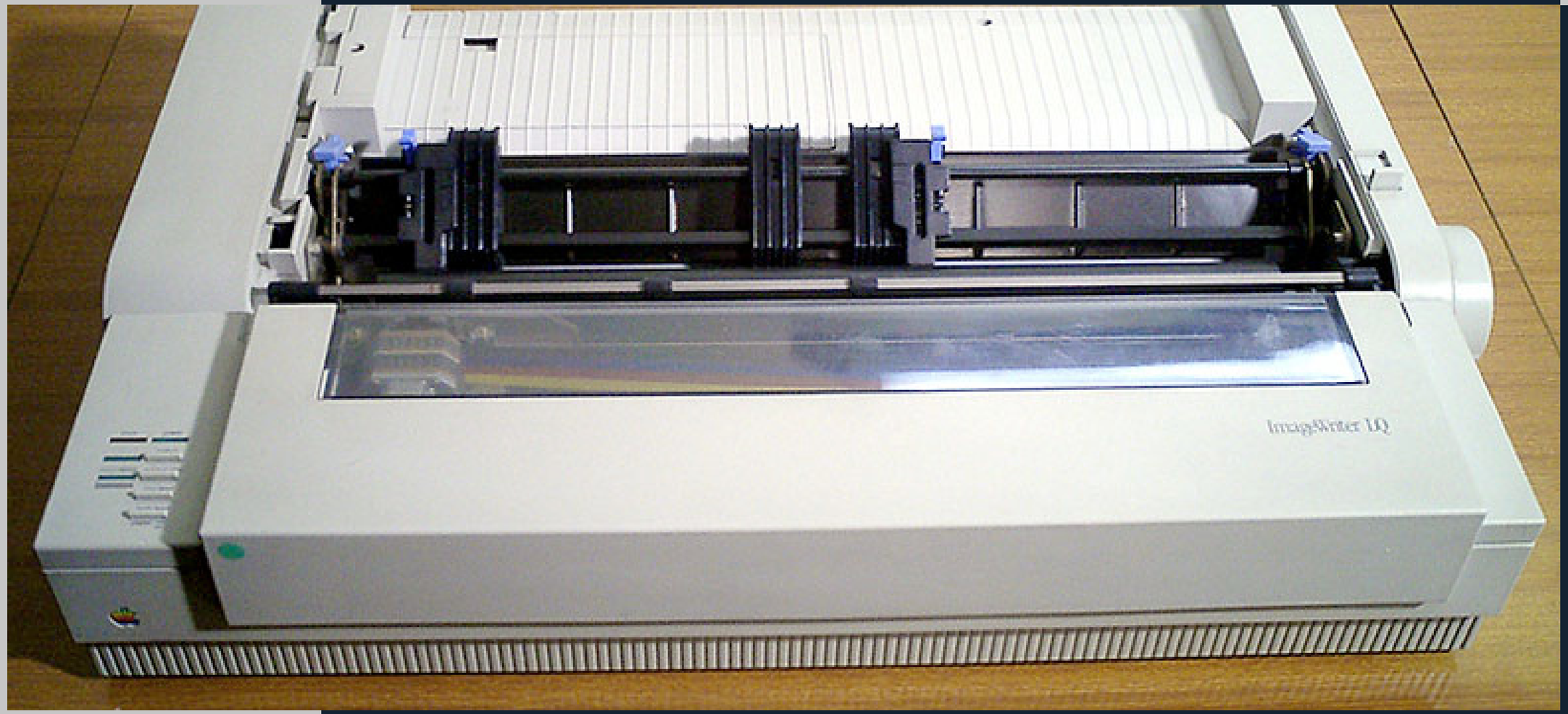
LA GRUA

CRANE STABILITY INNOVATIONS

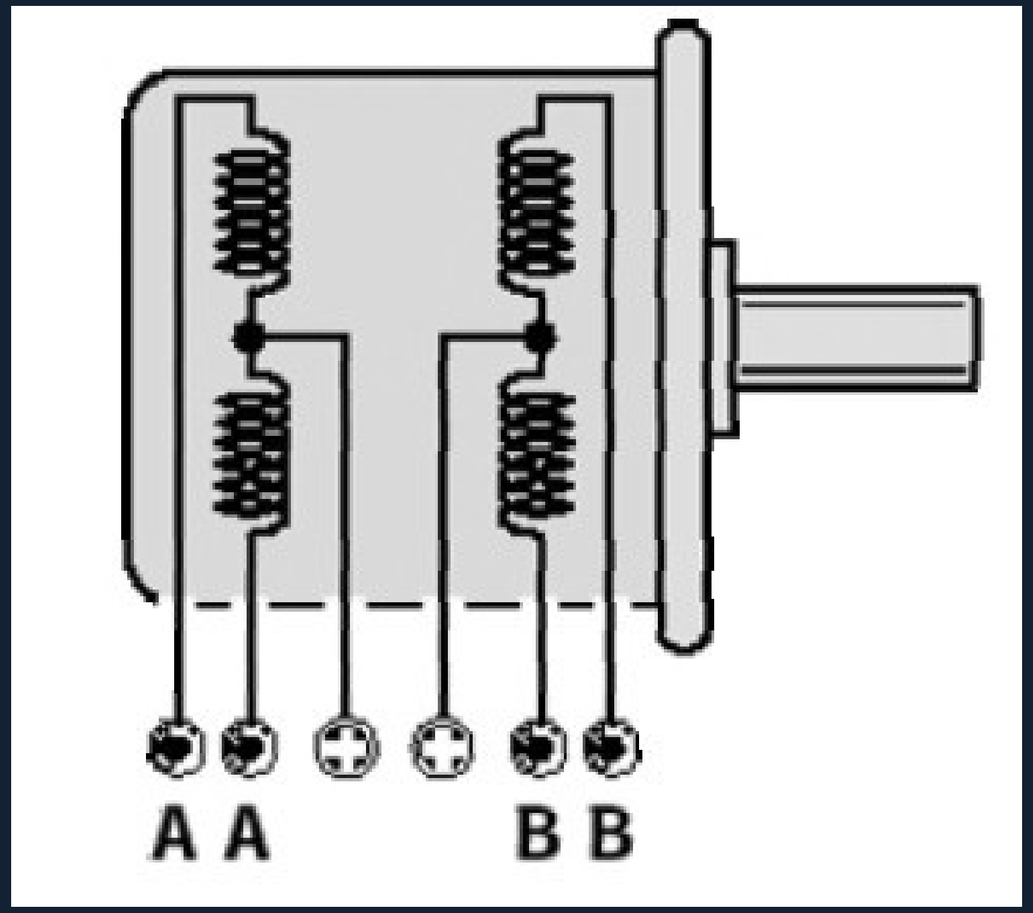


PUNTO DE PARTIDA

BASE DEL PROYECTO


ImageWriter LQ

Motor



L293D

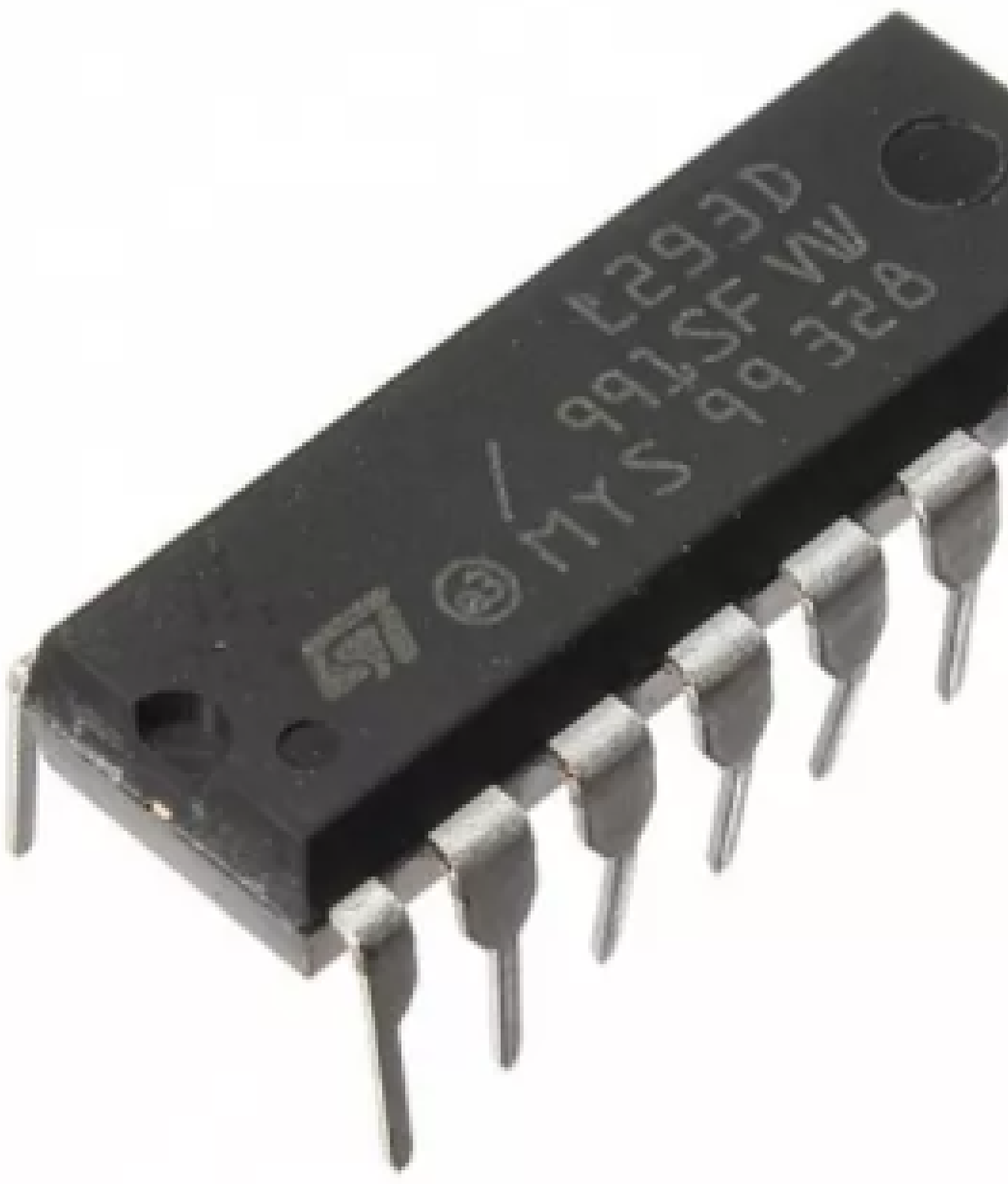
Unipolar

Giros de 1/8 de vuelta

Problemas

Lento

Poca resolución



Sensor

Grados mecánicos: 300°

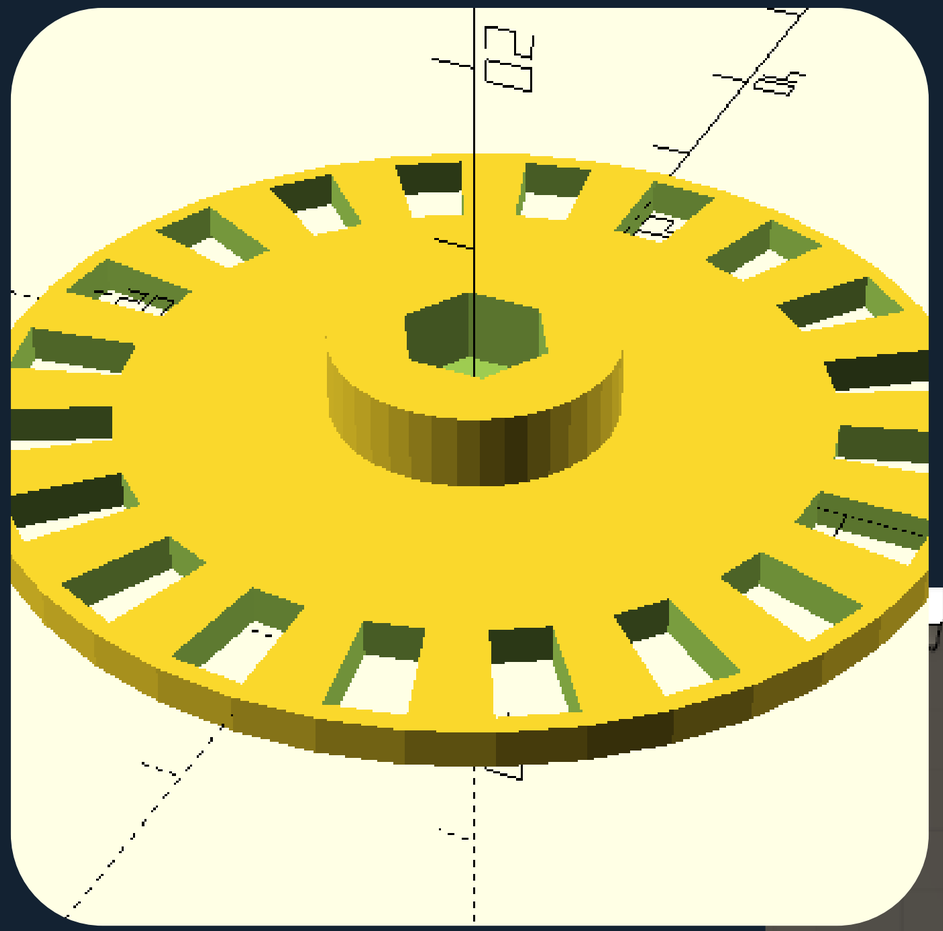
Resolución teórica: 0.30°

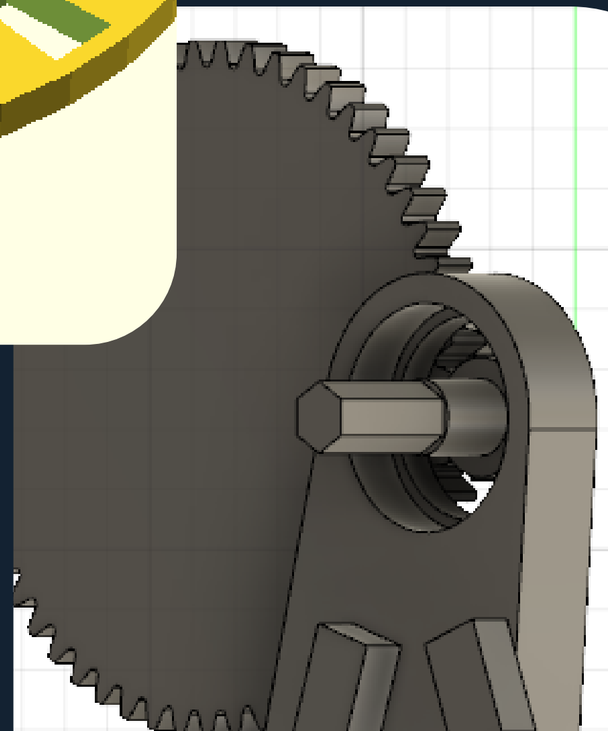
Problemas

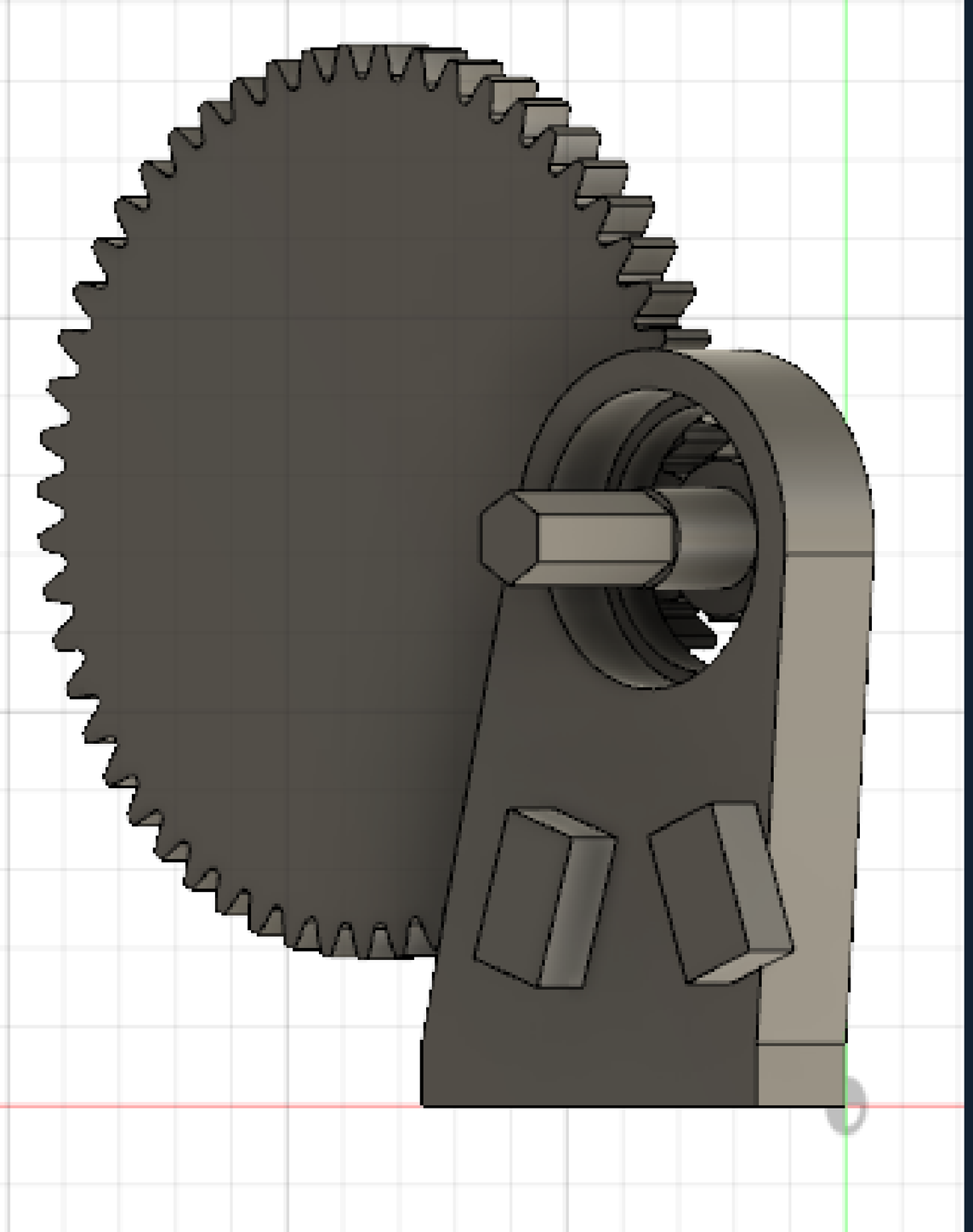
No tiene giro infinito

Mejoras

Sensor Encoder







Versión v2

Relacion 5:1

Resolución 0.45°

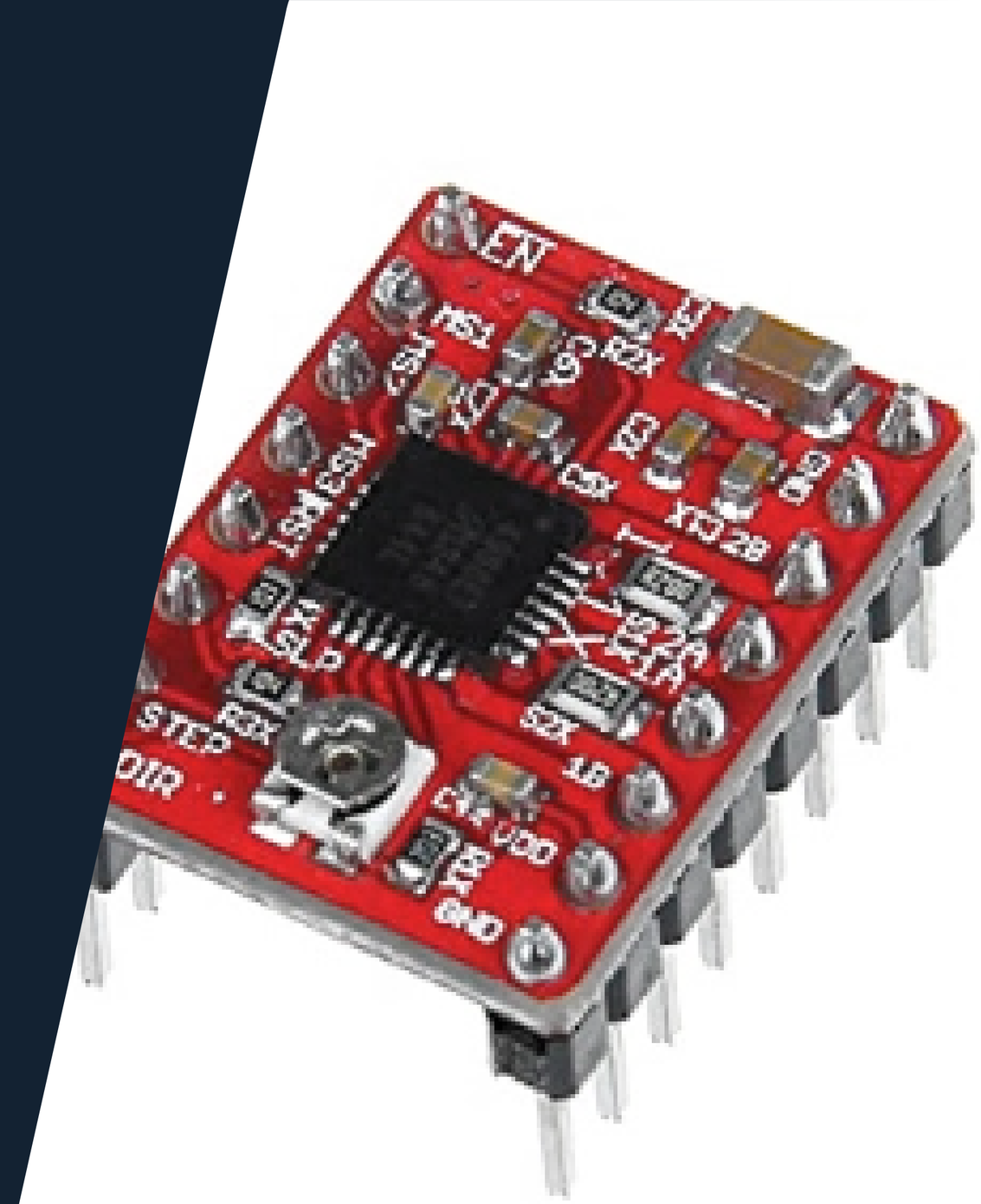
Detención de sentido

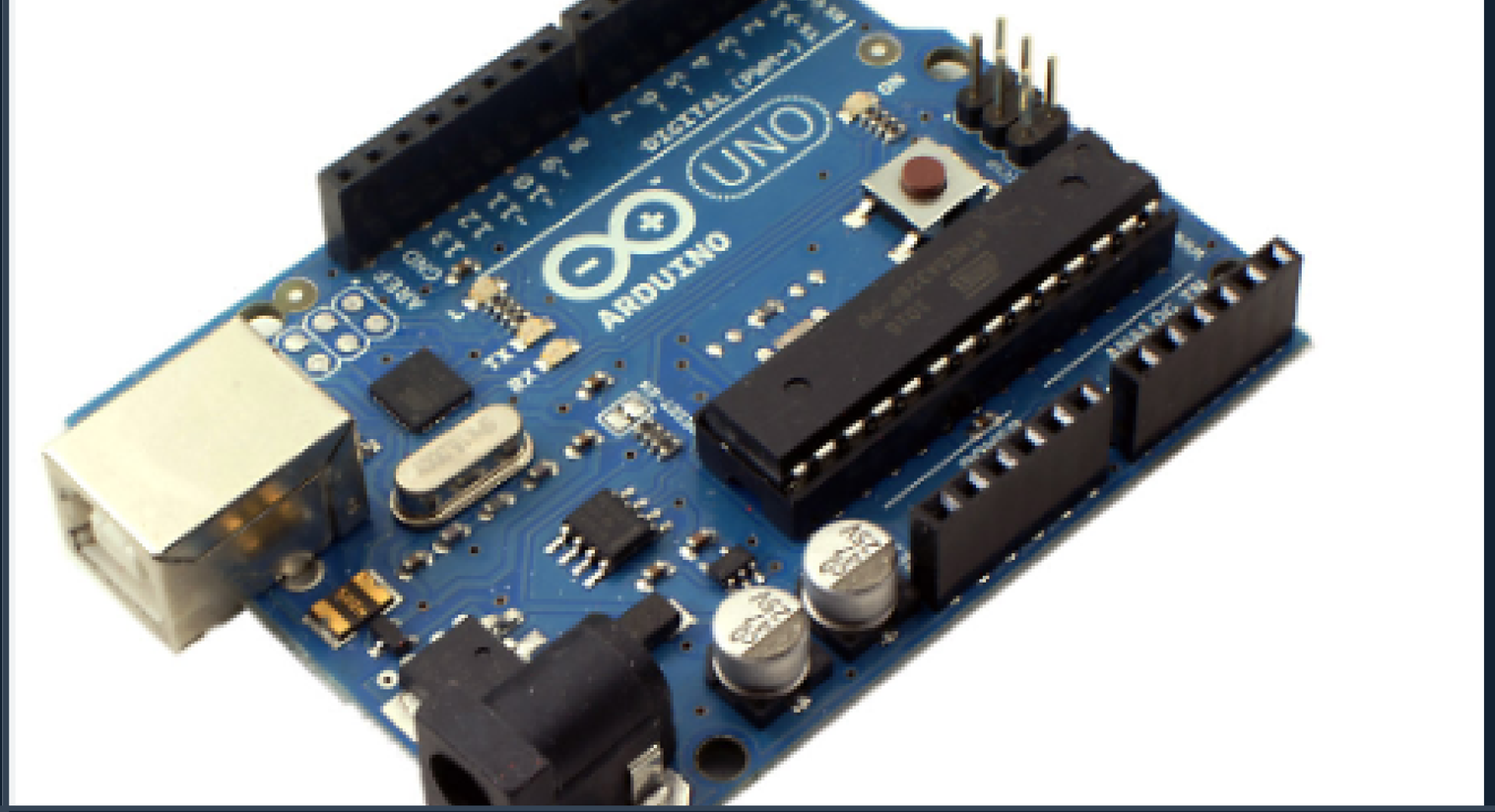
A4988

Bipolar

MicroPapos

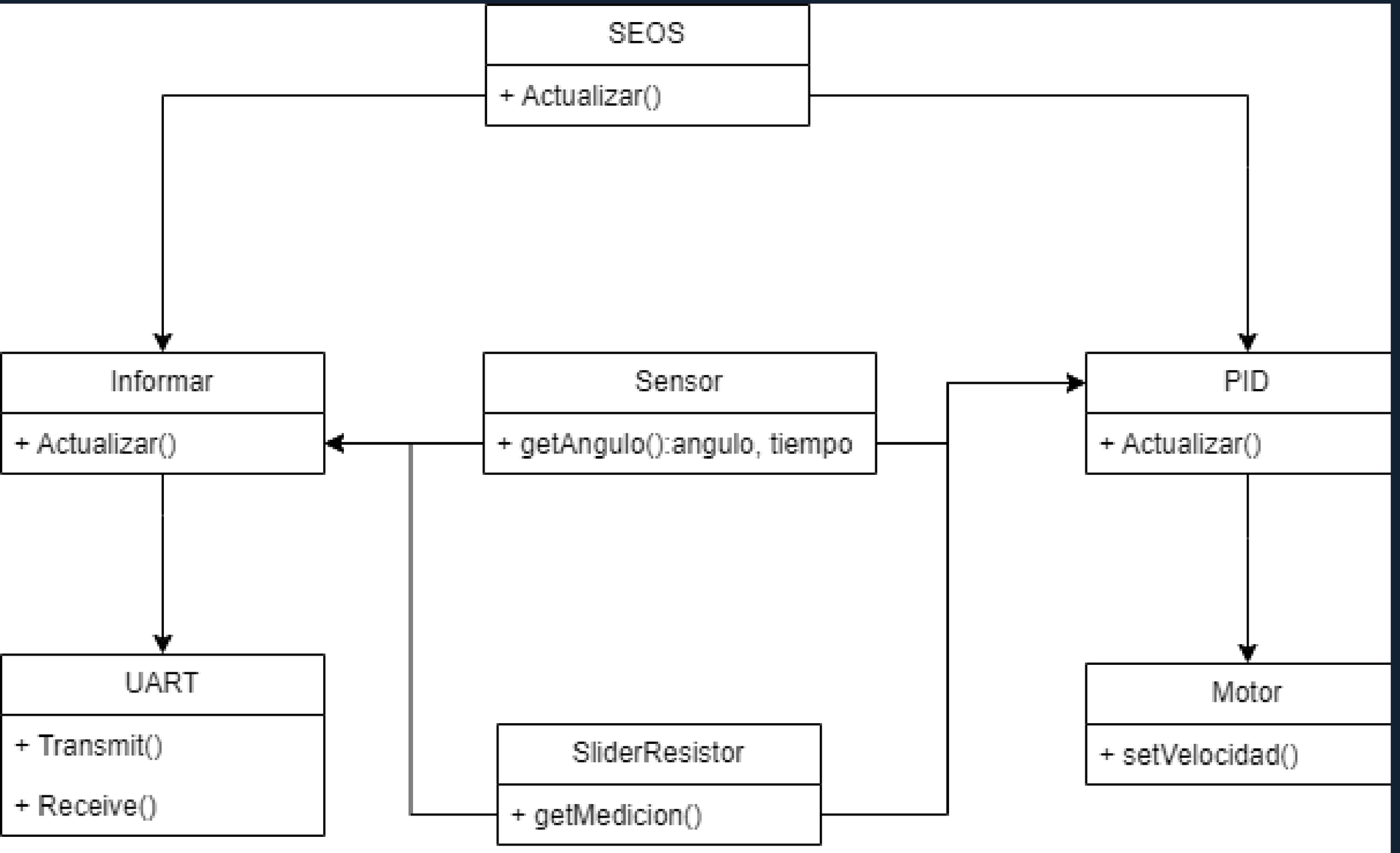
Mayor velocidad



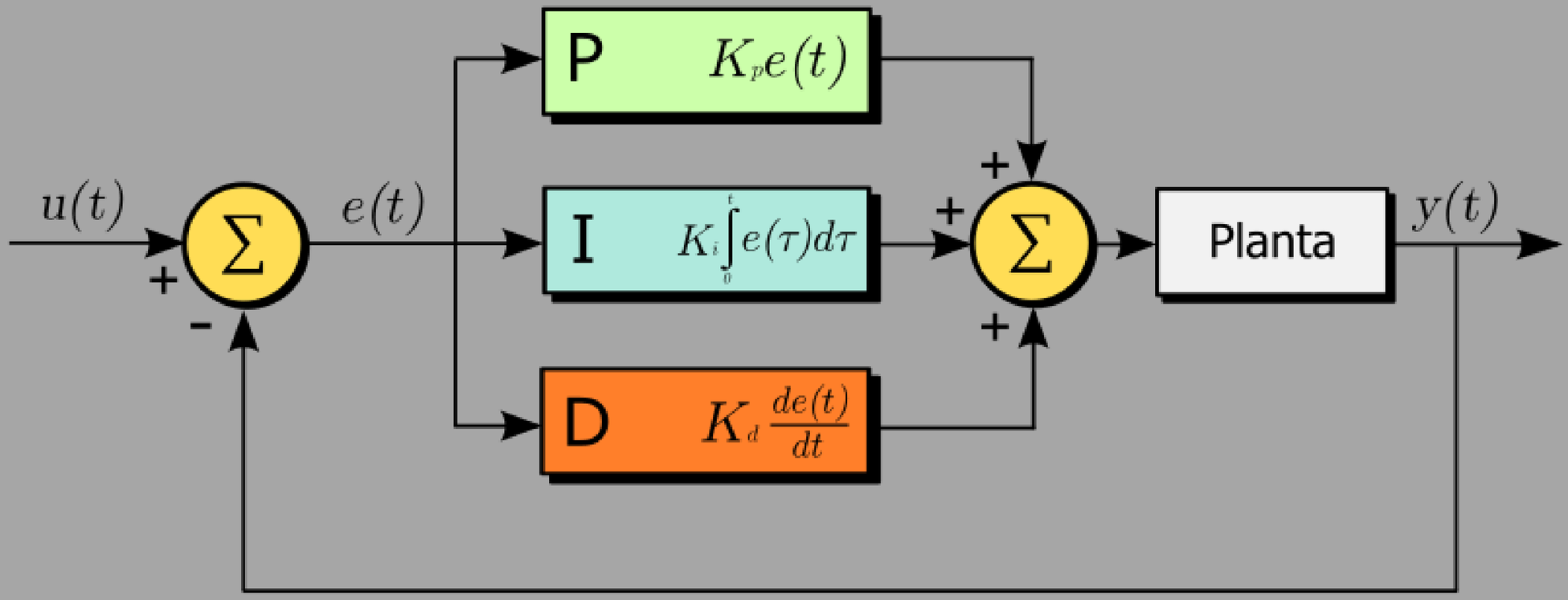


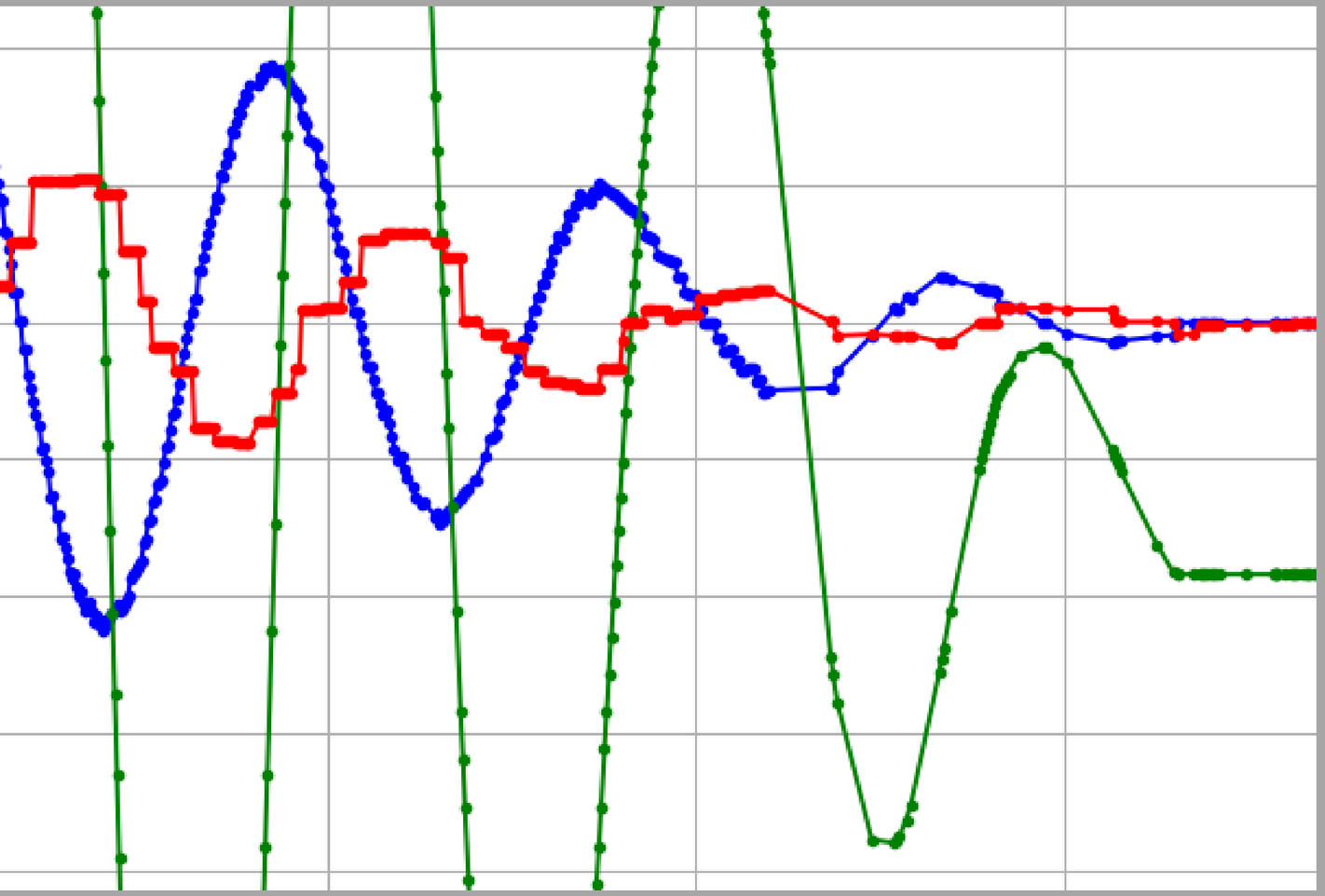
Programación

UML


SEOS
+ Actualizar()
Informar
+ Actualizar()
Sensor
+ getAngulo():angulo, tiempo
PID
+ Actualizar()
UART
+ Transmit()
+ Receive()
SliderResistor
+ getMedicion()
Motor
+ setVelocidad()

PID

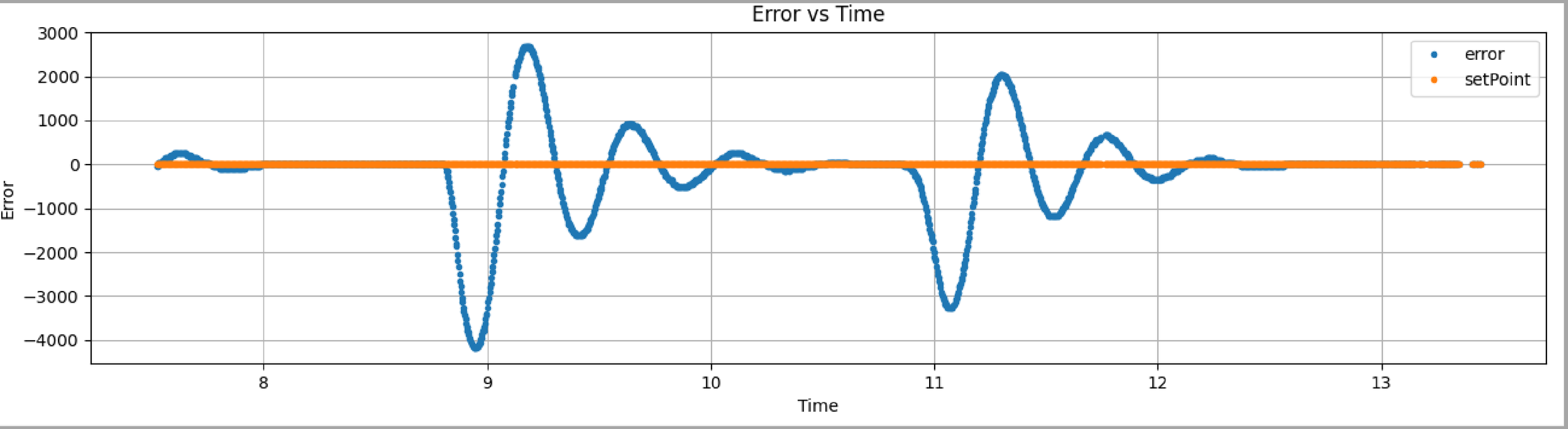




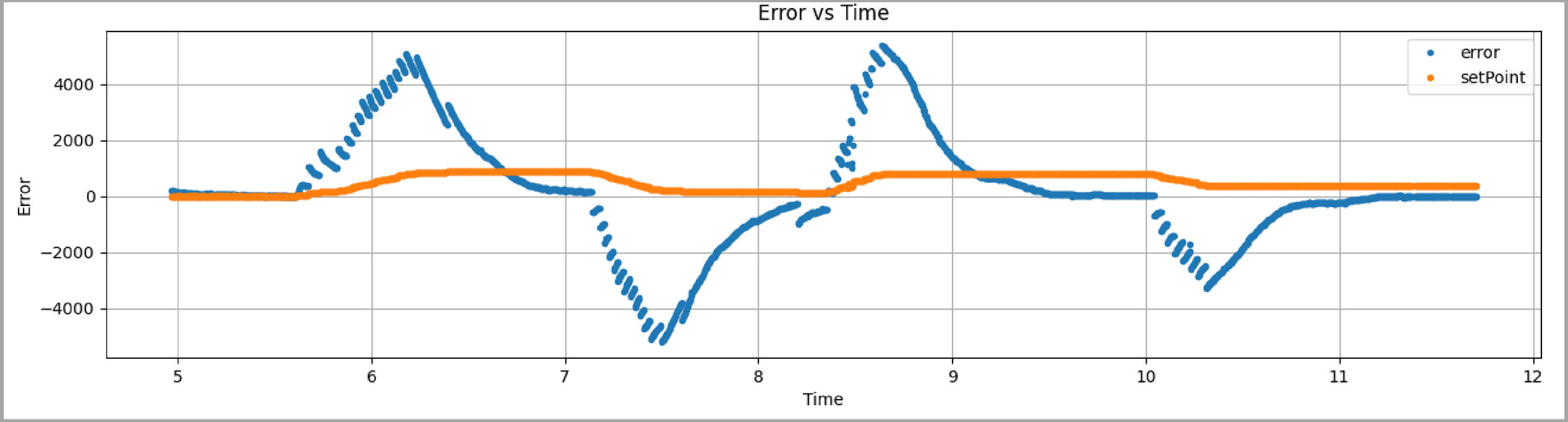
Problema

Derivada

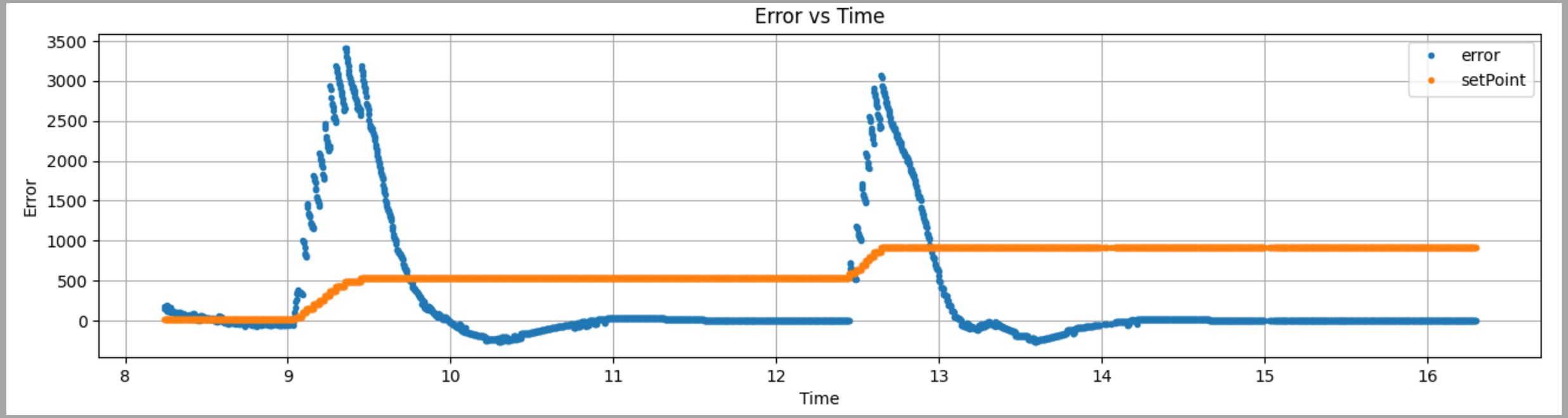
Angulo


Error vs Time
3000
2000
1000
0
−1000
−2000
−3000
−4000
Error
8
9
10
11
12
13
Time
error
setPoint

Posición sin Ki

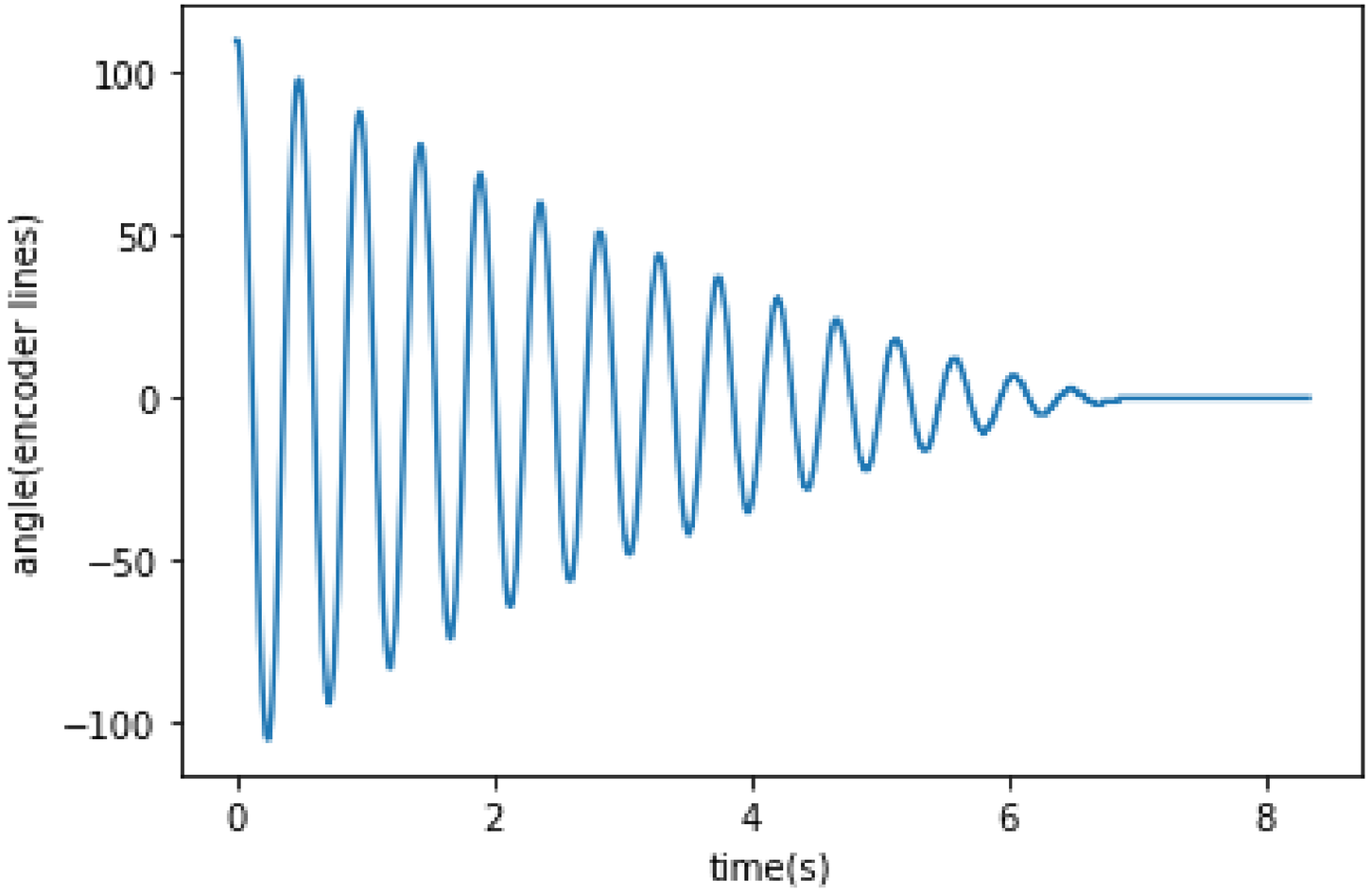


Posición con Ki



Modelado y simulación

Diagnosticar problemas y sintonizar ganancias



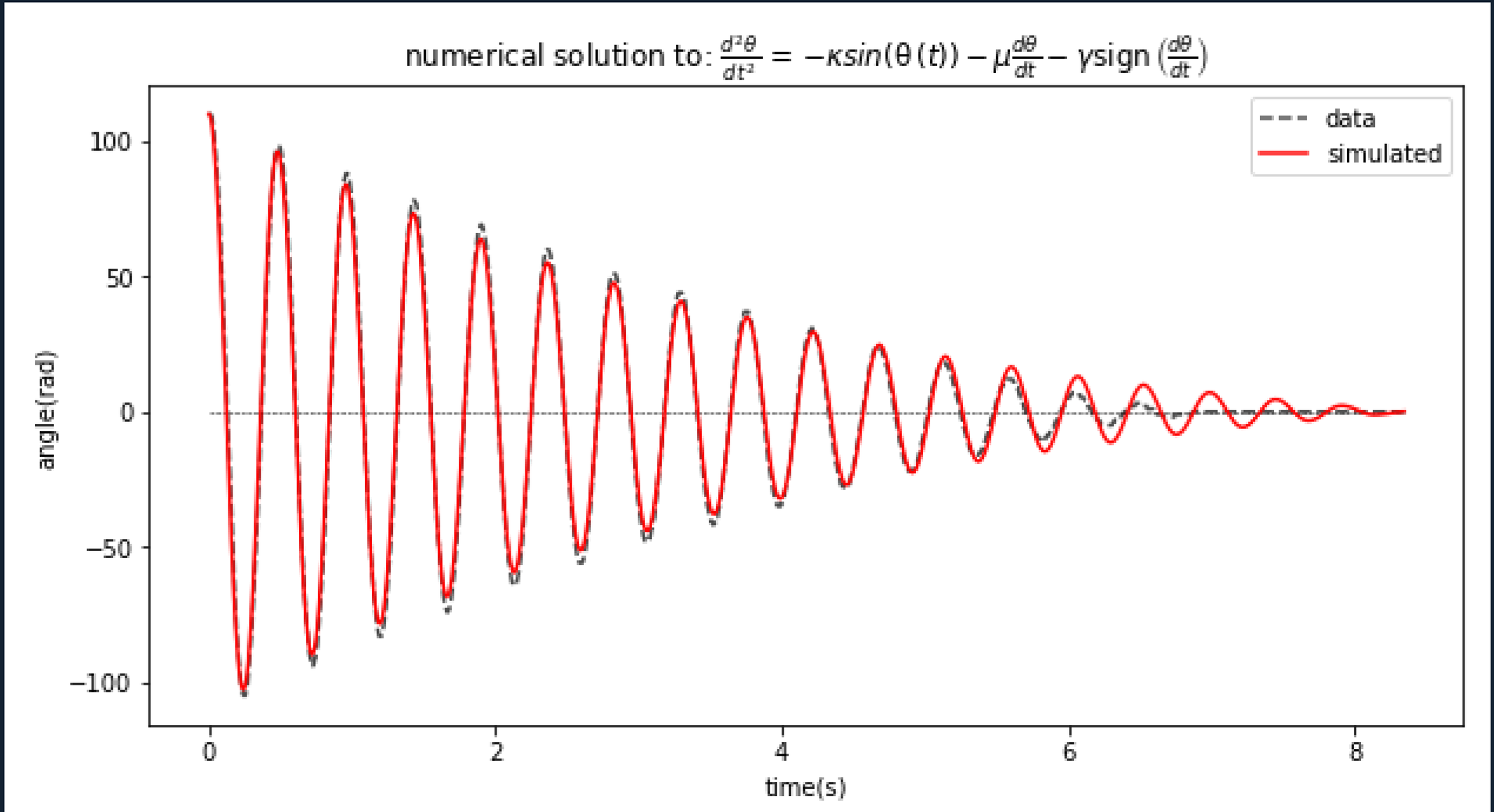
Recolección de data

Péndulo en caída libre medido con el sensor

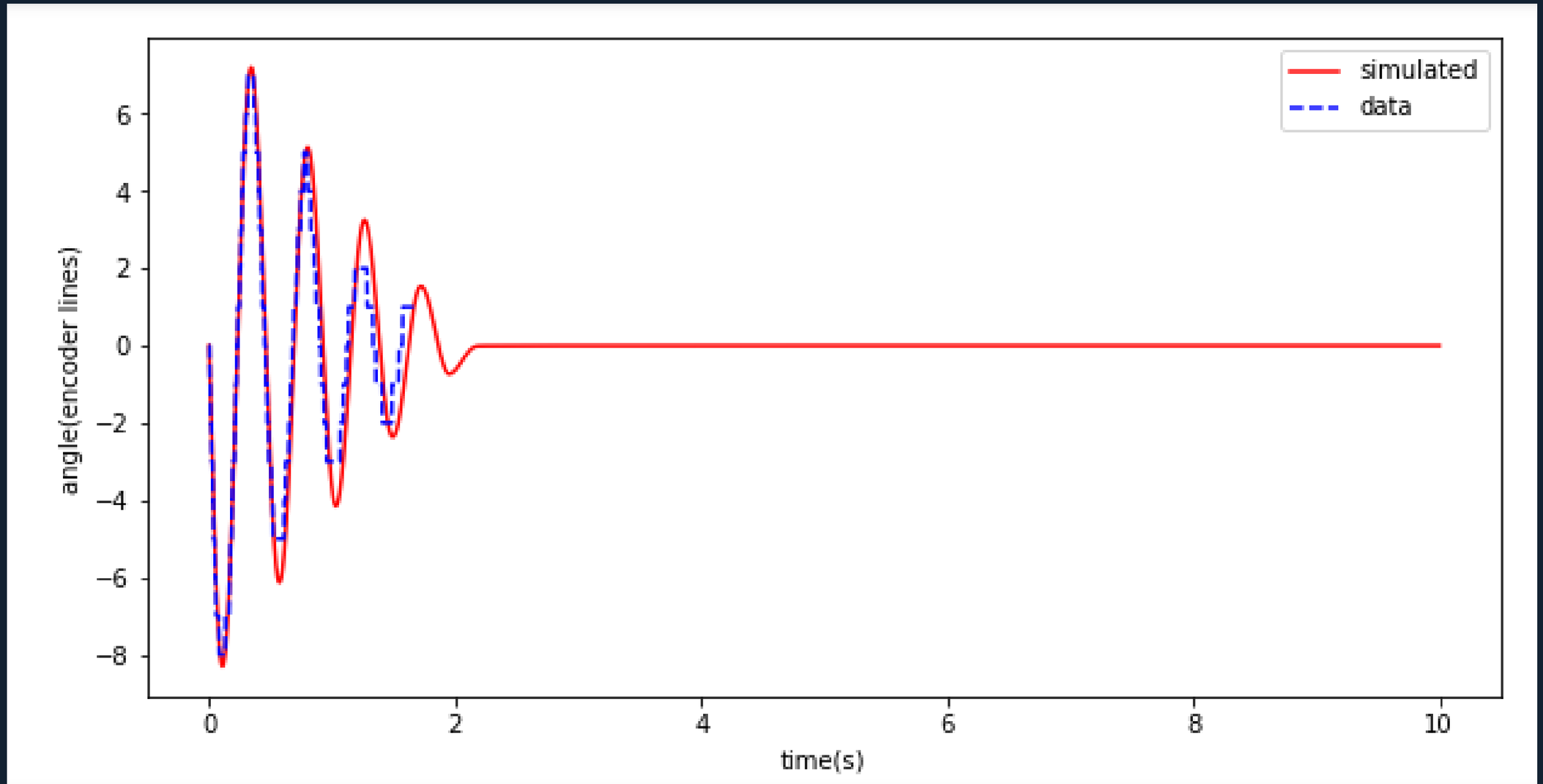
Modelo

$$\frac{d^2\theta}{dt^2} = \frac{\kappa}{g} a\cos(\theta) - \kappa\sin(\theta) - \mu\theta' - \gamma\text{sign}(\theta'$$

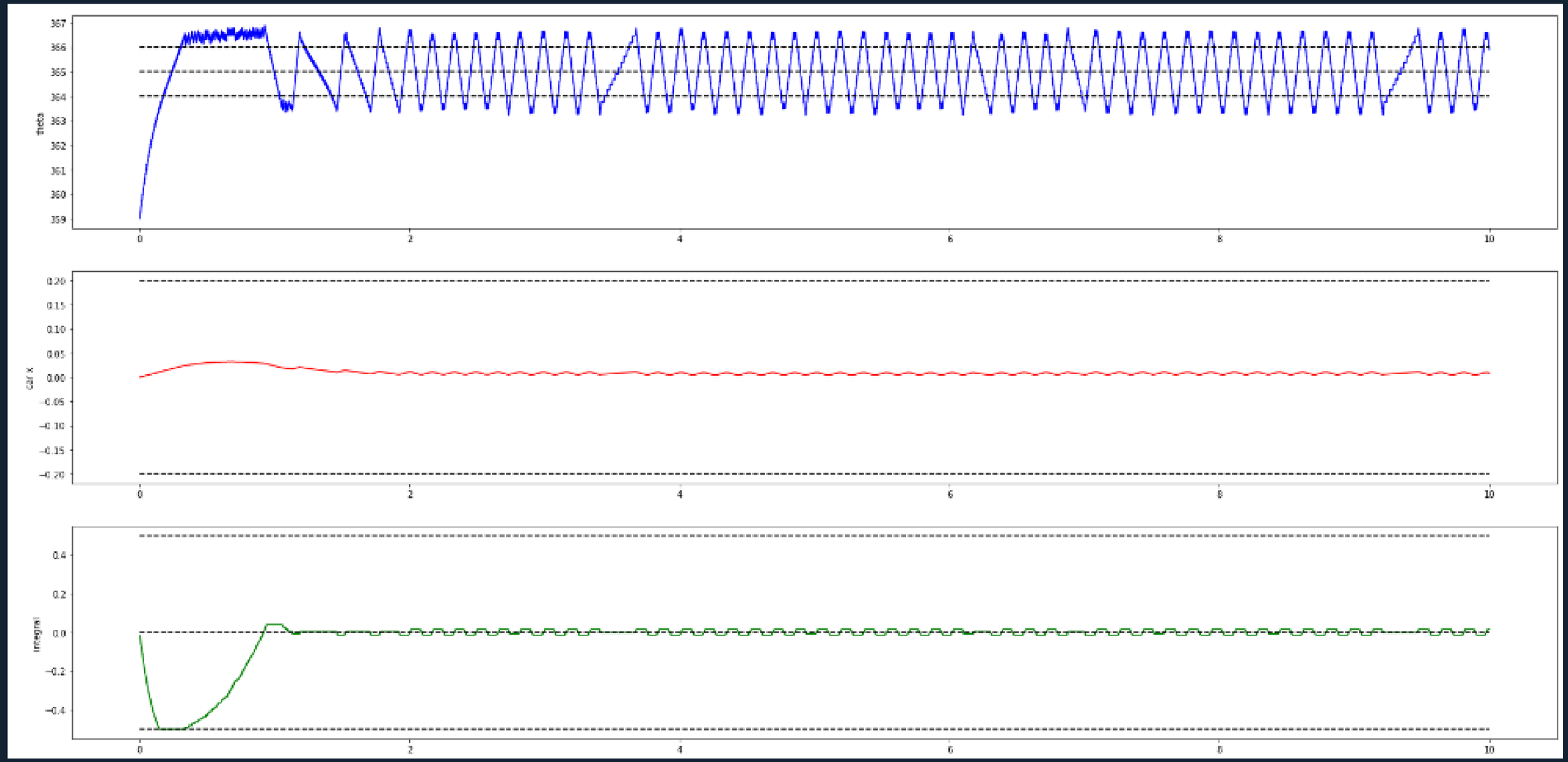
Ajuste del modelo a la data



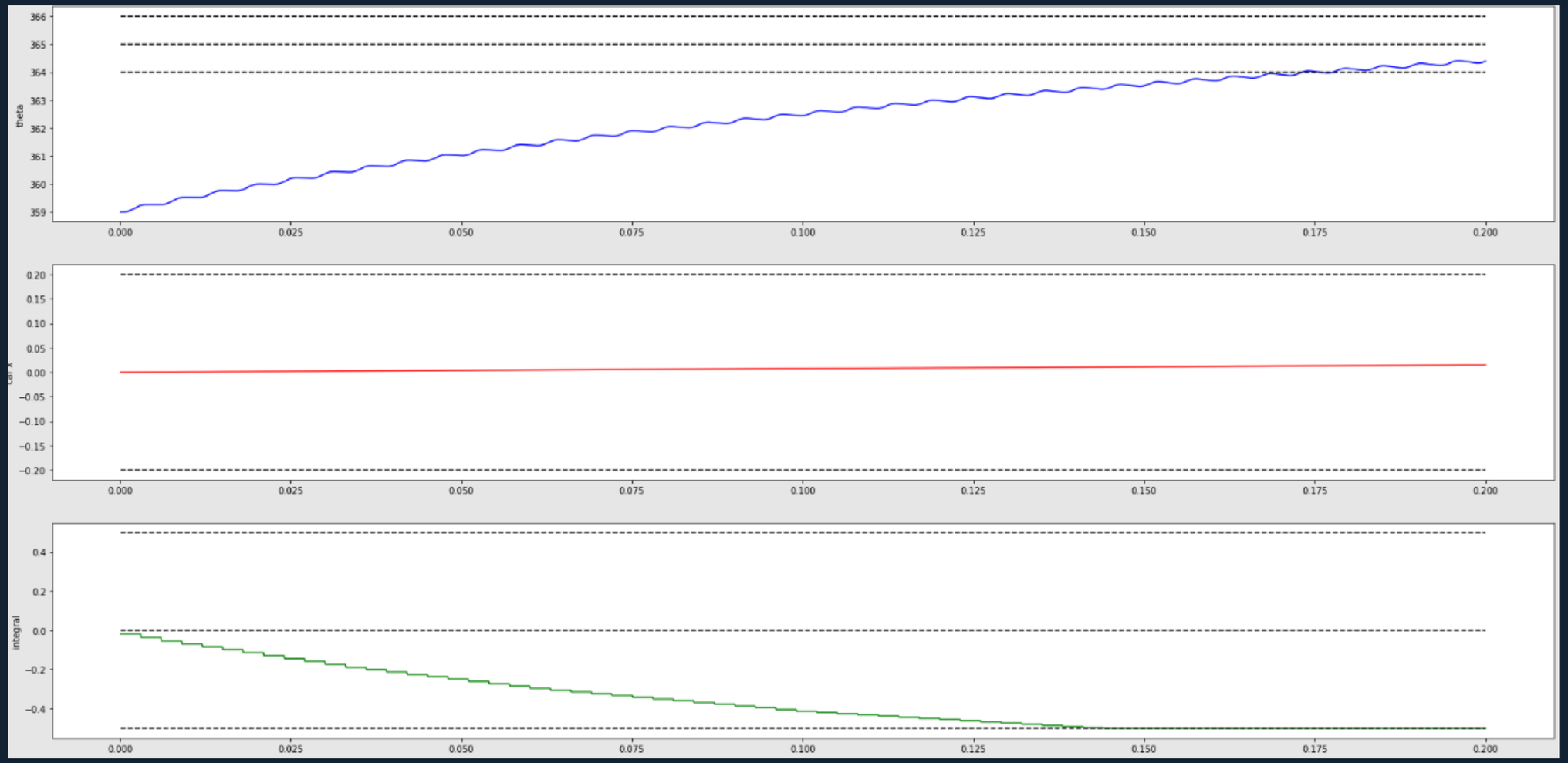
Testeo del modelo
Escalon en velocidad



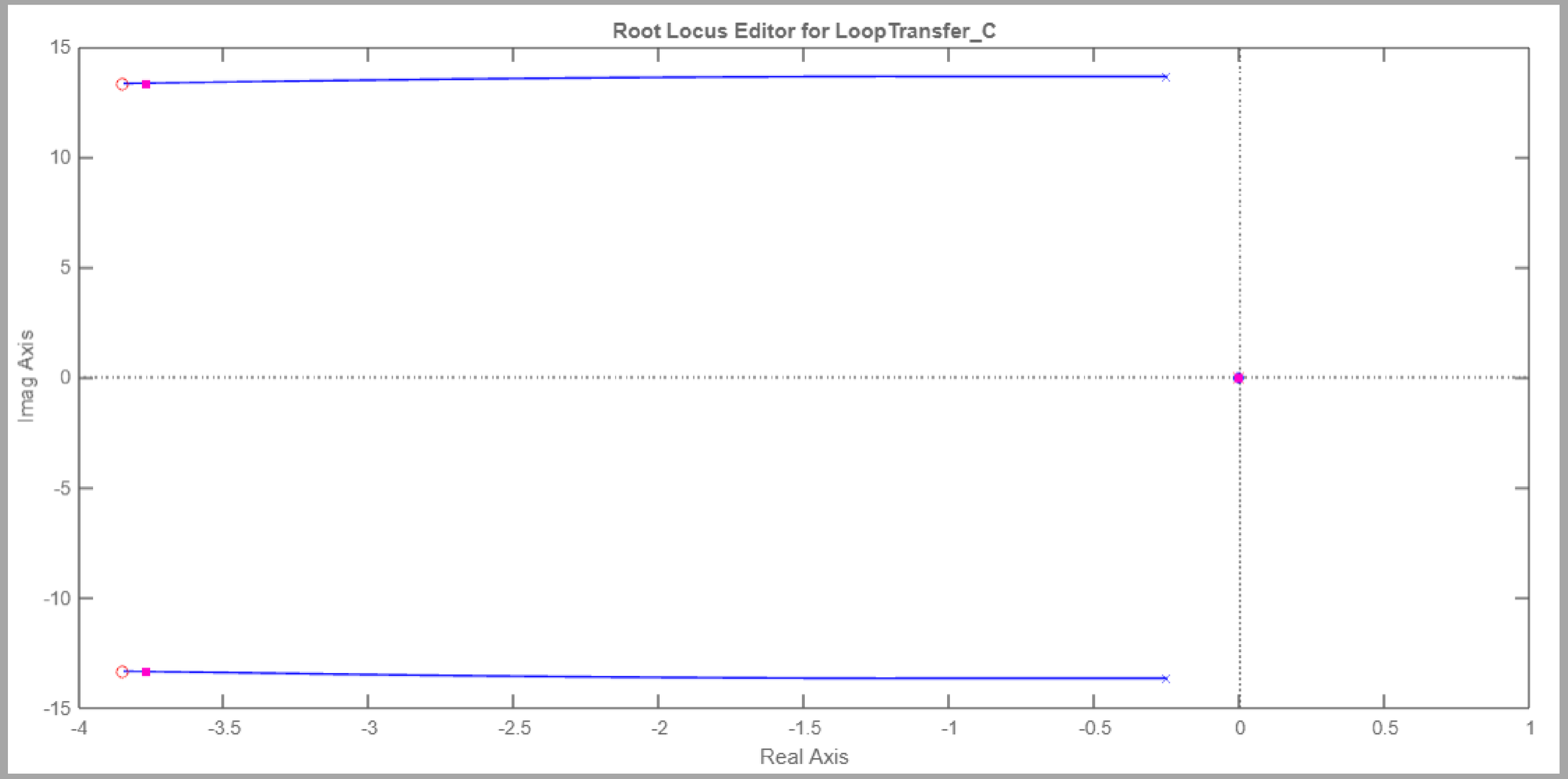
Simulación del PID



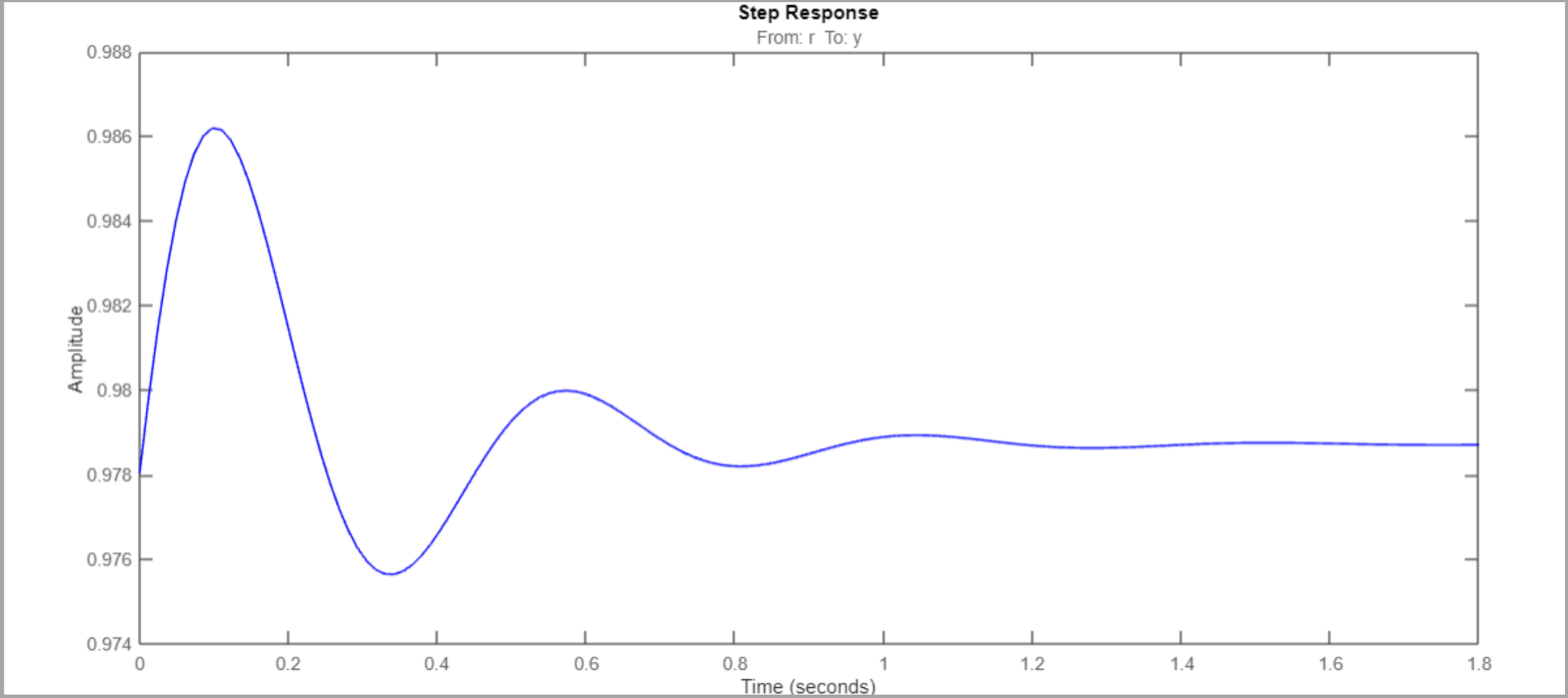
Simulación del PID

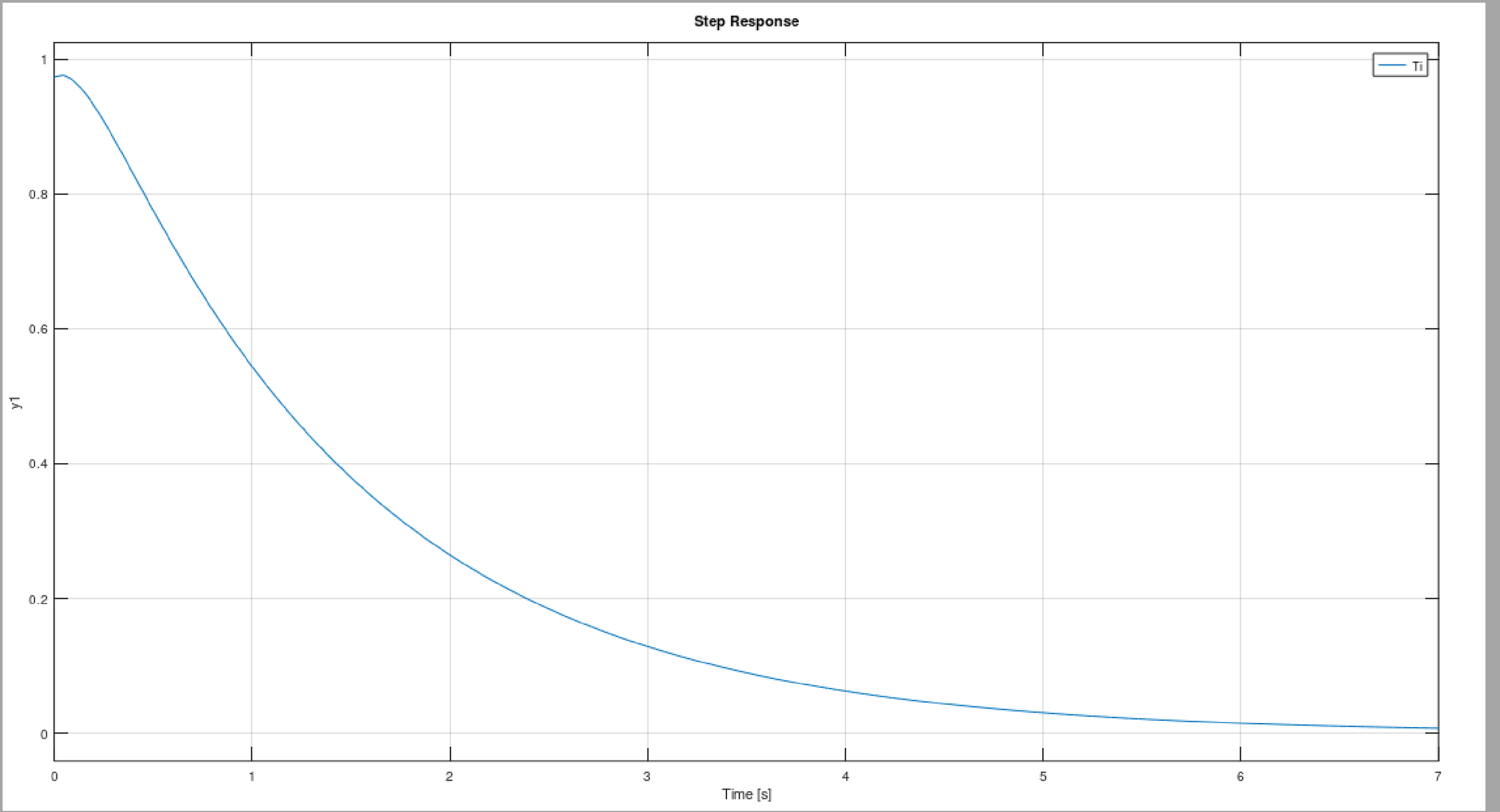


Angulo

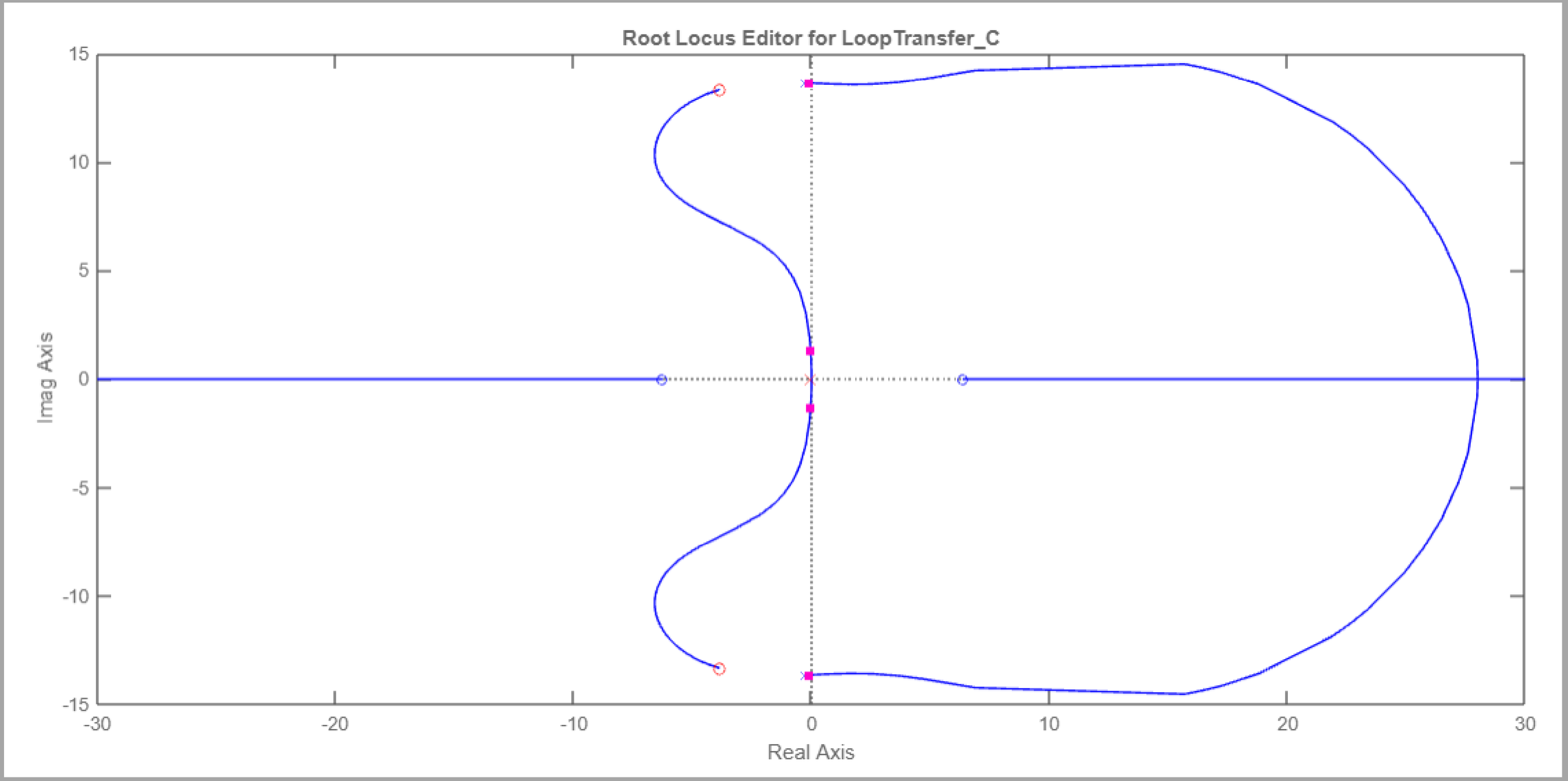

Root Locus Editor for LoopTransfer_C
Imag Axis
Real Axis
15
10
5
0
-5
-10
-15
-4
-3.5
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
1

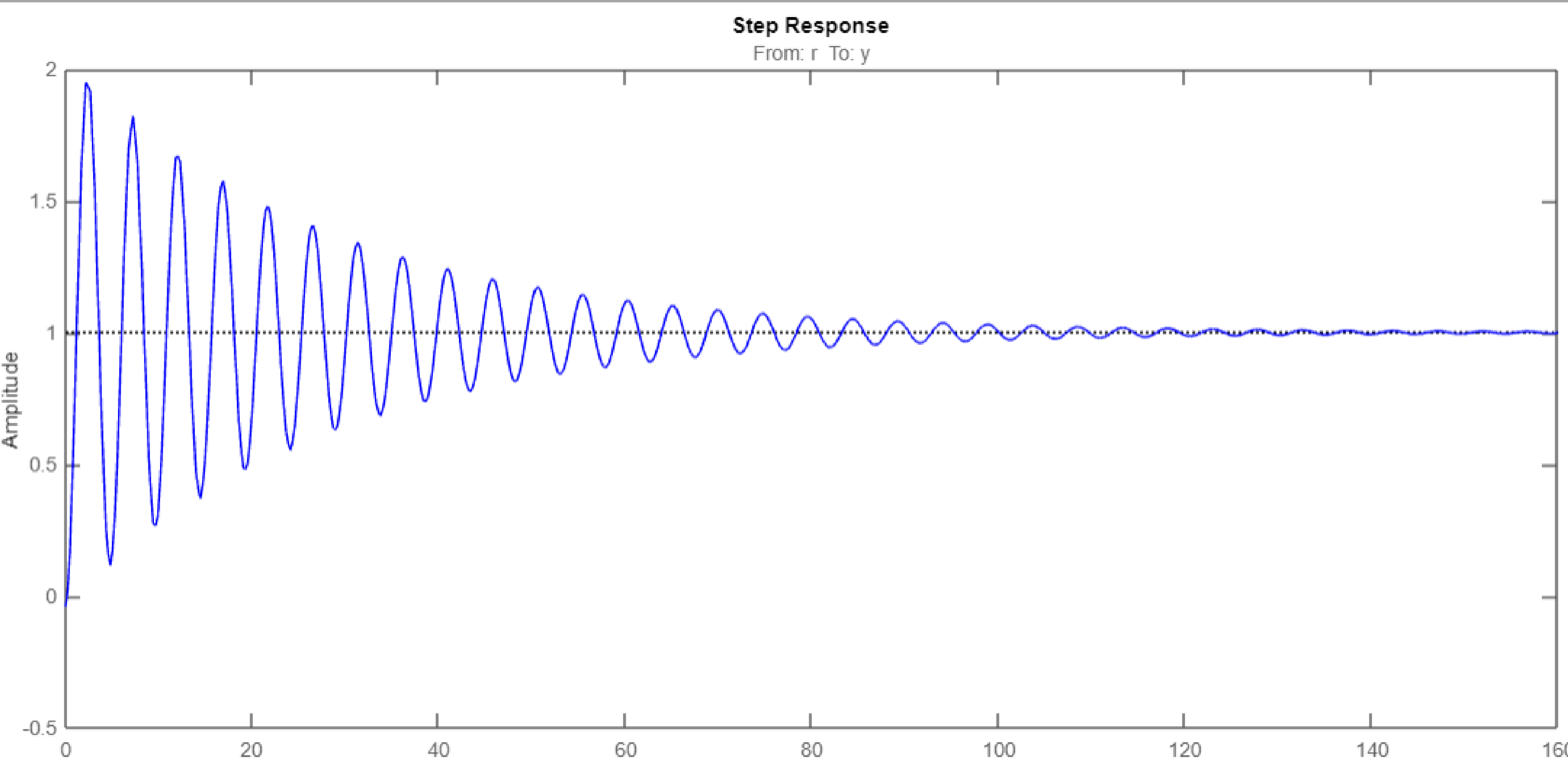
Step


Step Response
From: r To: y
0.988
0.986
0.984
0.982
0.98
0.978
0.976
0.974
Amplitude
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
Time (seconds)


Step Response
Ti
y1
Time [s]
0
0.2
0.4
0.6
0.8
1
0
1
2
3
4
5
6
7

Posición


Root Locus Editor for LoopTransfer_C
Imag Axis
Real Axis
15
10
5
0
-5
-10
-15
-30
-20
-10
0
10
20
30


Step Response
From: r To: y
Amplitude
2
1.5
1
0.5
0
-0.5
0
20
40
60
80
100
120
140
160

Diagnostico de problemas

Problemas

- Falta de potencia del motor
- Bordes de la impresora
- Acumulacion de errores del encoder

Soluciones

- Cambio de motor
- Ganancia integral
- Remplazo de la polea del encoder por engranajes y mejora del codigo

La resolucion del encoder no resulto un problema significante