Technical University of Cluj-Napoca

Faculty of Automation and Computer Science

**Project:**

DC STABILIZED SWITCHED MODE POWER SUPPLY

C.

The Controllers design

2023-2024

**C.1. Controller design**

For the project we had to use two different kinds of controllers:

* **Proportional**
* **Proportional-Integral**

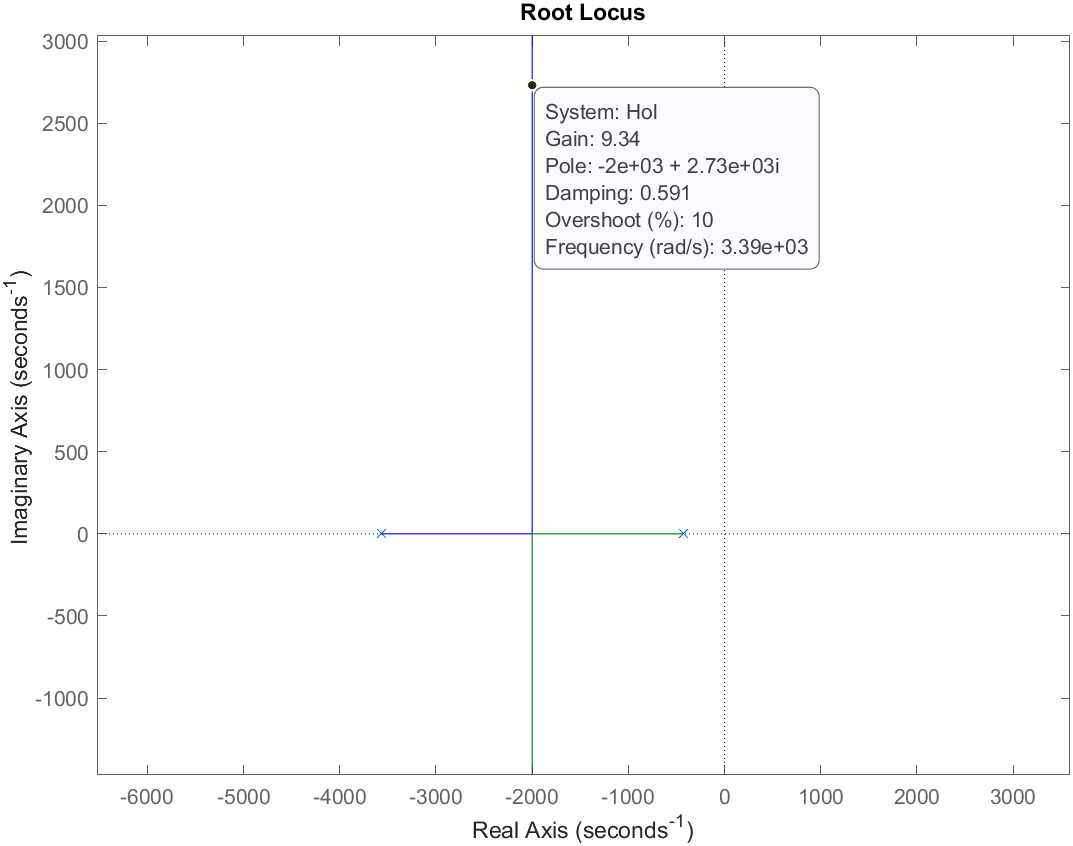
The transfer function of the fixed part:

**C.1.1 Proportional Controller Design**

Because has two real negative a P controller will not ensure a steady state error .

We will impose the following performance characteristic for the overshoot

We can use the root locus of the fixed transfer function to tune our controller:



Therefore the value for

**C.1.2 Proportional-Integral Controller Design**

We will impose the following performance characteristic for the overshoot

The controller transfer function will be:

We will take witch is the dominant time constant in our process and we will cancel it.

We can again use the root locus of the fixed transfer function to tune our controller:

A graph with a red line and green line

Description automatically generated

Therefore the value for and .

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**Project:**

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D.

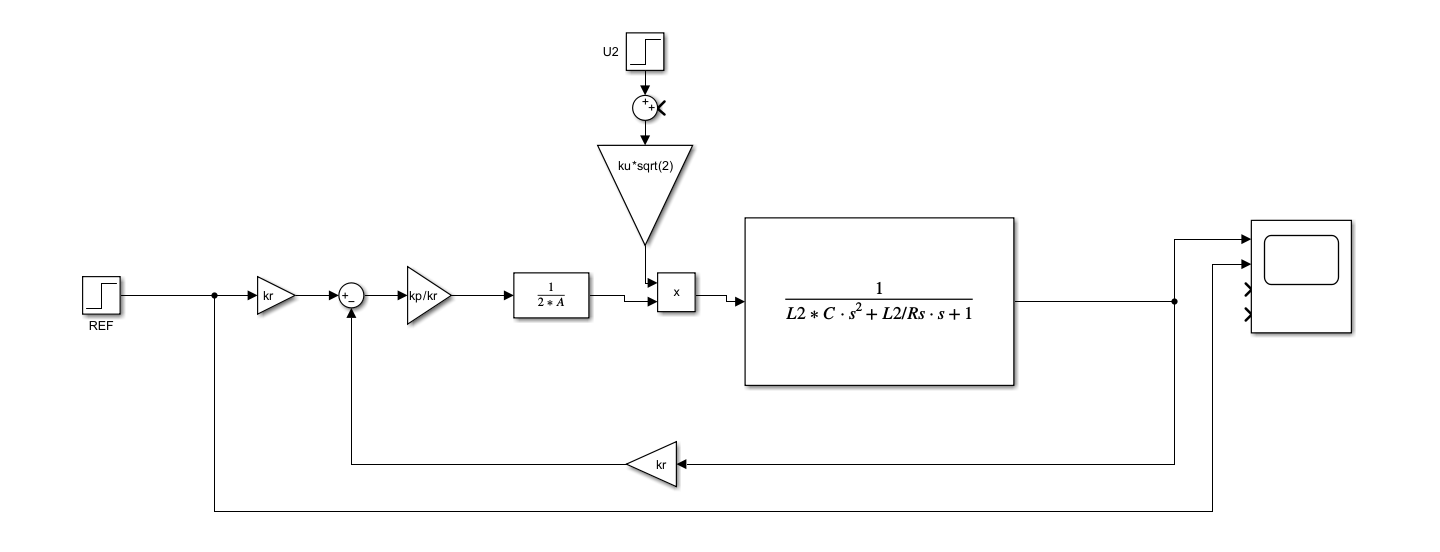
The simulation of the stabilized DC power supply

2023-2024

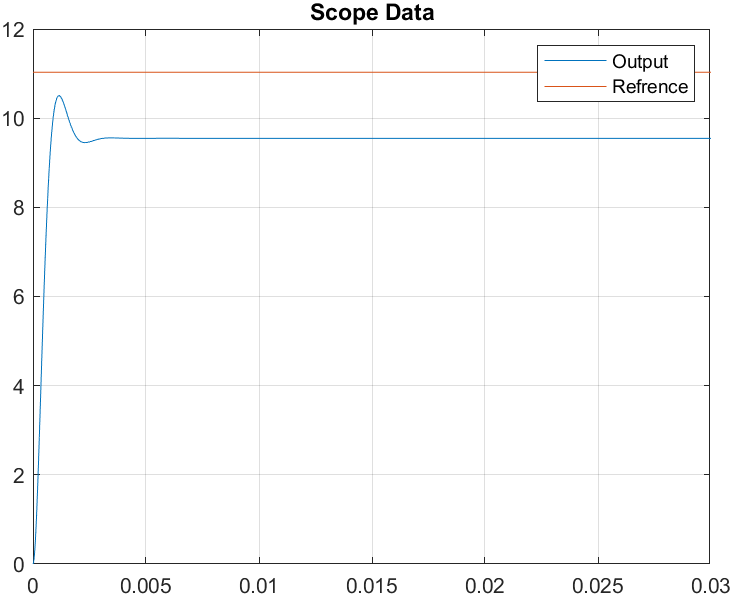
**D.1. Step response**

**D.1.1 Step response on the P controller:**

We have the following simplified mathematical model of the DC power supply:



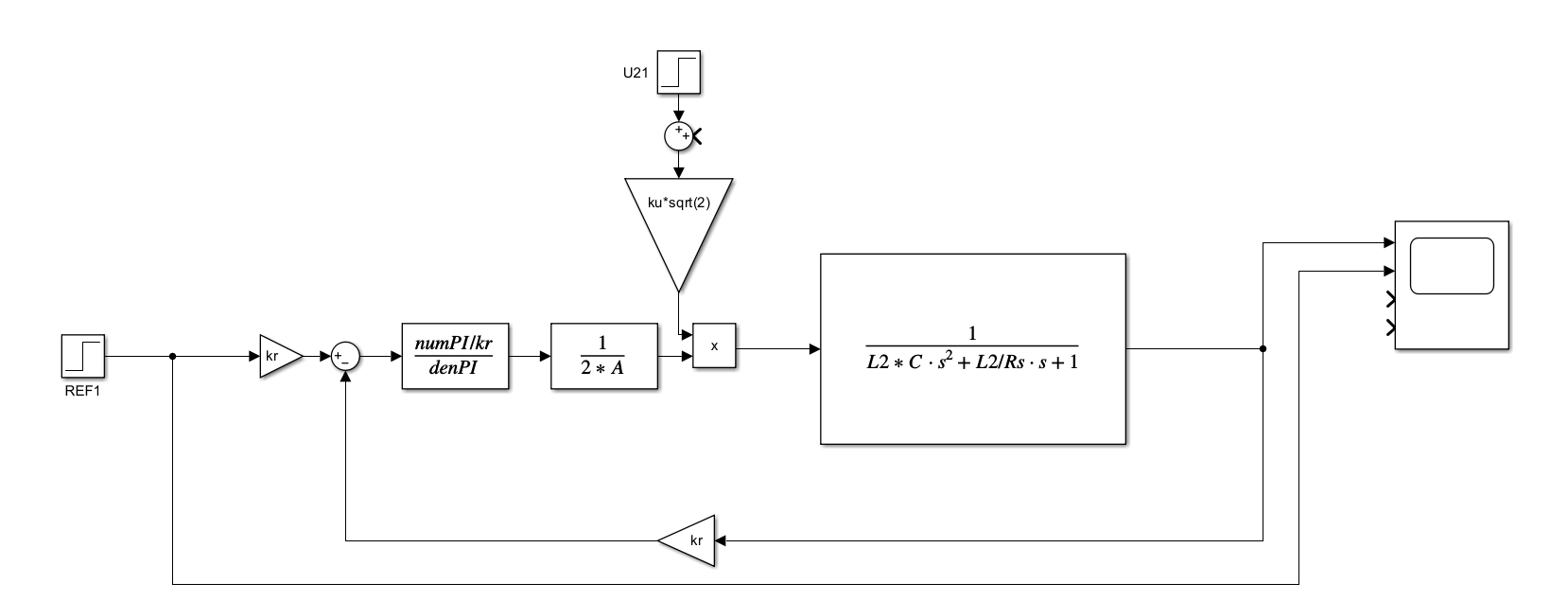
The reference will be: thus giving the following simulation:



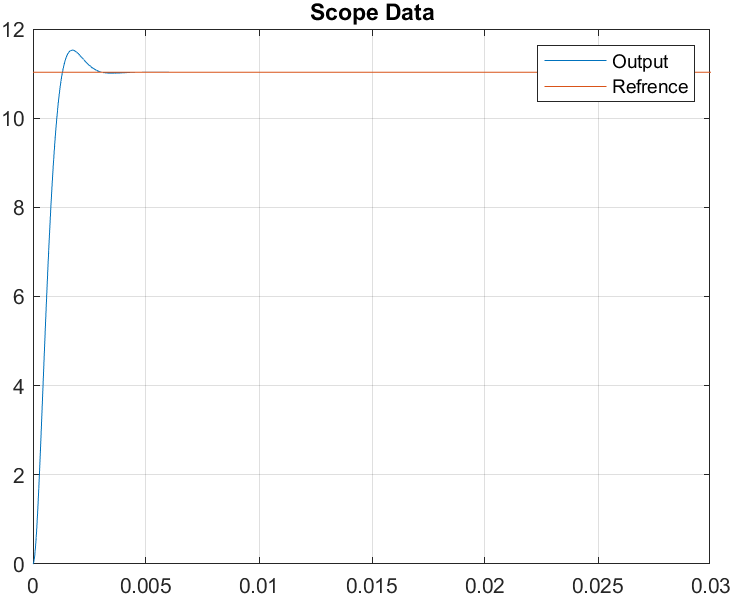
The output has an overshoot of: and a steady state error of: .

**D.1.2 Step response on the PI controller:**

The simplified mathematical model of the DC power supply is:



With the same reference voltage as before we have the following response:

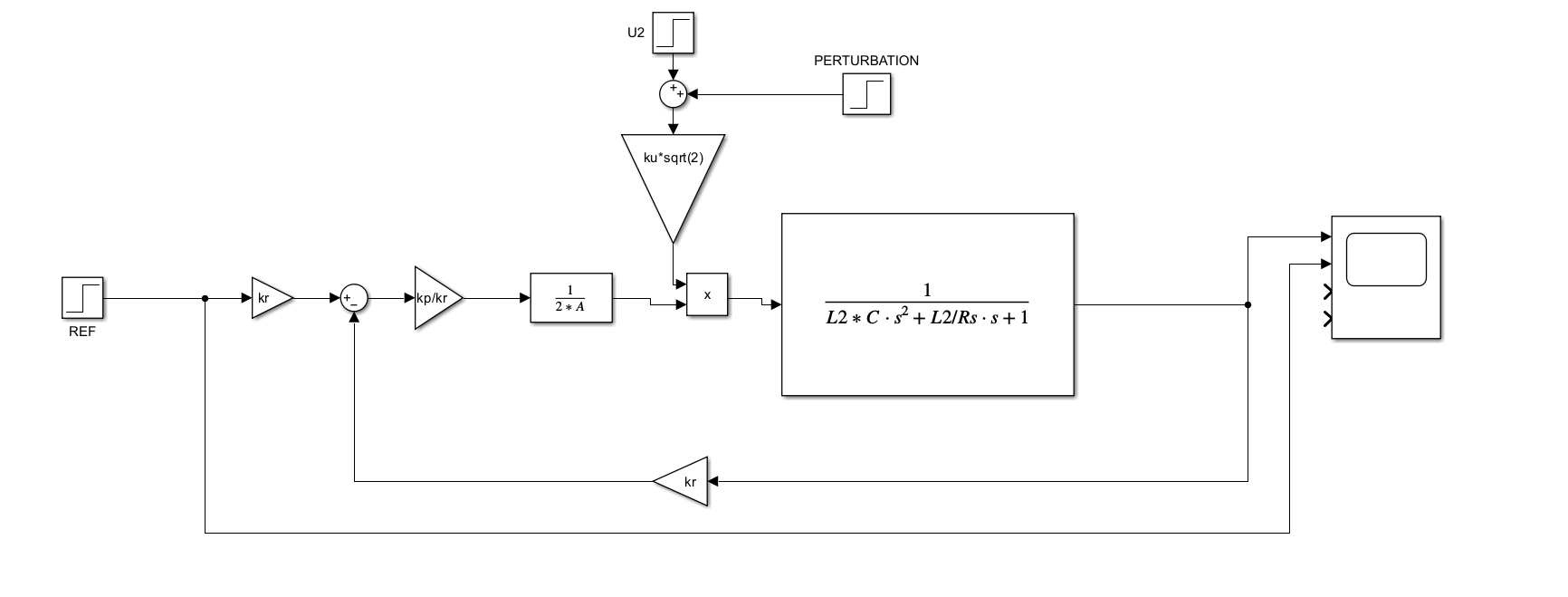


We see that the overshoot is no more than and the steady state error .

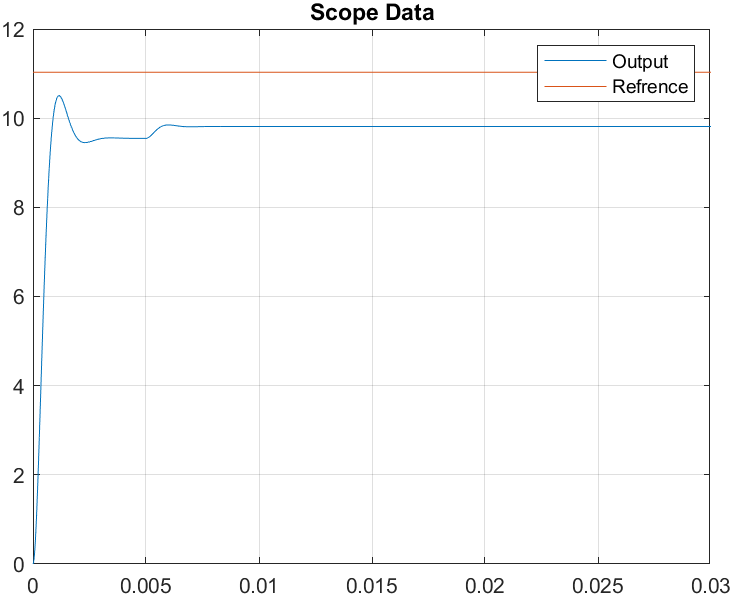
**D.2. Step response with disturbance to the input**

**D.2.1 Input disturbance on the P controller:**

I added a perturbation of at the moment in time 0.005 seconds.

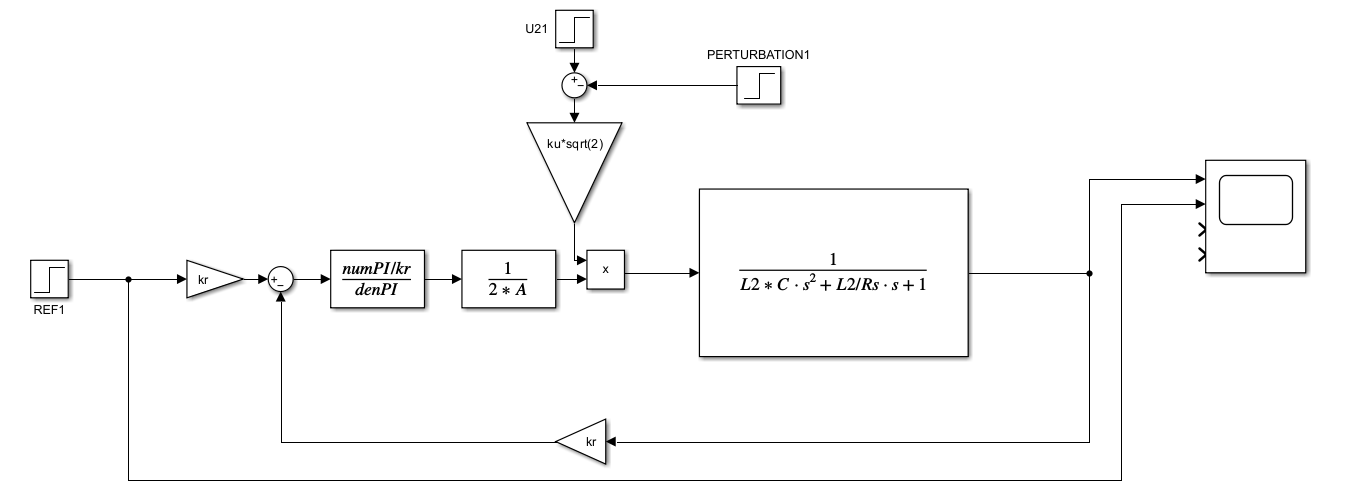


And this is the result of the simulation:

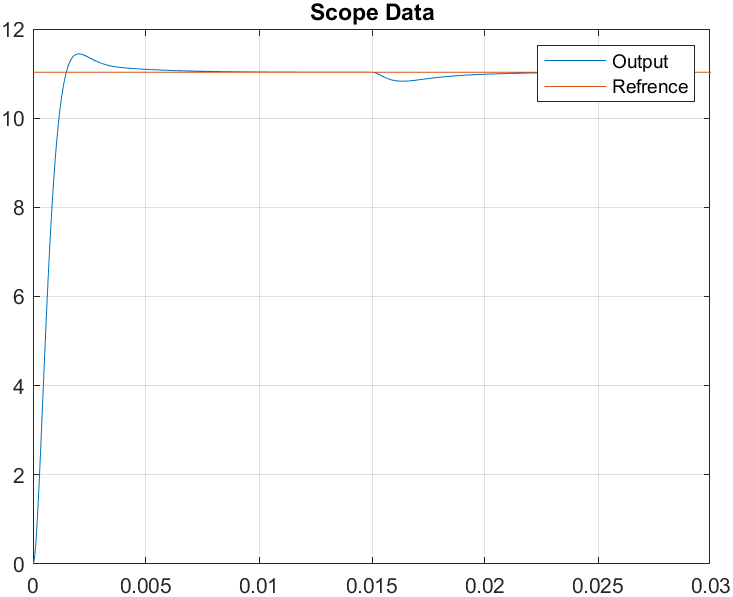


**D.2.2 Input disturbance on the PI controller:**

I added a perturbation of at the moment in time 0.015 seconds.



And this is the result of the simulation:



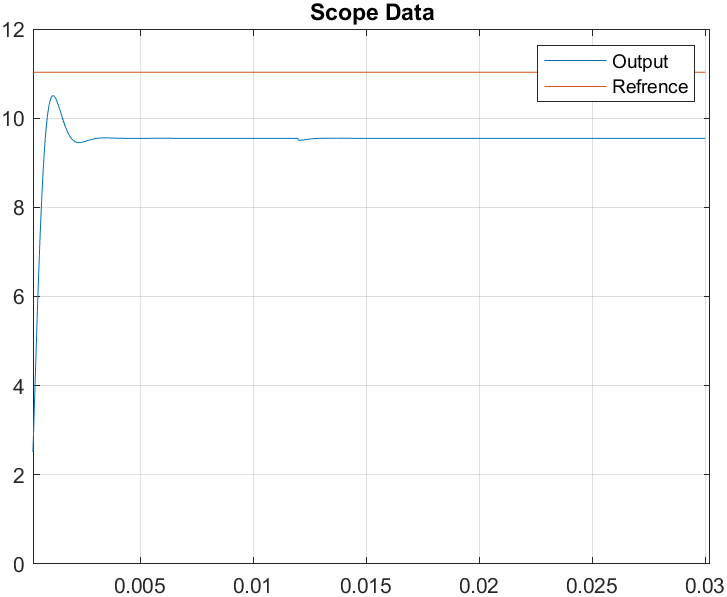
**D.3. Step response with disturbance to the output**

**D.3.1 Output disturbance on the P controller:**

I added a perturbation of at the moment in time 0.012 seconds.

A group of black and white math symbols

Description automatically generated with medium confidence

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**D.3.2 Output disturbance on the PI controller:**

I added a perturbation of at the moment in time 0.012 seconds.

A diagram of a mathematical equation

Description automatically generated

