Teaching materials
Guide notes 0. Introduction to the Platform

MISCE project

Mechatronics for Improving and Standardizing Competences in Engineering

Competence: Control Engineering

Workgroup: Universidad de Castilla-La Mancha
Universitat Politècnica de València

© 2025 MISCE Consortium. Licensed under CC Attribution-ShareAlike 4.0 International
(https://creativecommons.org/licenses/by-sa/4.0/)

This document corresponds to the introduction lecture, presenting the experimental platform, for the competence ‘Control Engineering’ using the ‘DC-motor control platform’

Version: 1.0

Date: October 5th, 2023

Visit https://misceproject.eu/ for more information.

Index of contents

1 Platform overview 2
2 App description 3
2.1 Operation mode 1: Motor warm up 4
2.2 Operation mode 2: Open loop response 5
2.3 Operation mode 3: Velocity control (actions) 6
2.4 Operation mode 4: Velocity control (zeros/poles) 7
2.5 Operation mode 5: Position control (actions) 8
2.6 Operation mode 6: Position control (zeros/poles) 9

Index of figures

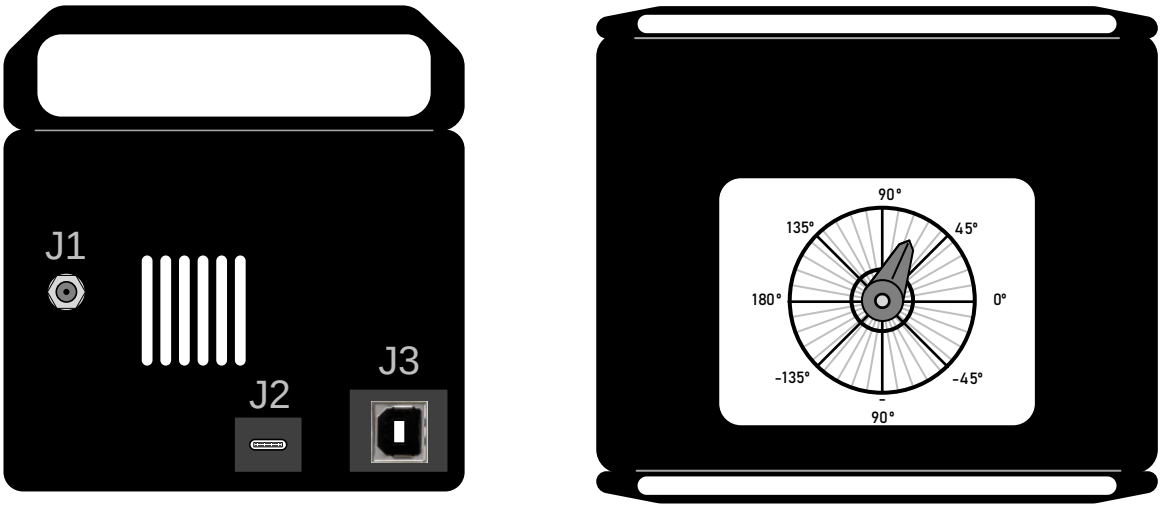
Figure 1. Experimental platform overview 2
Figure 2. a) Connectors' side; b) Dial side 2
Figure 3. Overall view of the DC-Motor Control app 3
Figure 4. Operation mode 1: Motor warm up 4
Figure 5. Operation mode 2: Open loop response 5
Figure 6. Operation mode 3: Velocity control (actions) 6
Figure 7. Operation mode 4: Velocity control (zeros/poles) 7
Figure 8. Operation mode 5: Position control (actions) 8
Figure 9. Operation mode 6: Position control (zeros/poles) 9

1 Platform overview

The final aspect of the experimental platform is shown in Figure 1.

Figure 1. Experimental platform overview

The main functional elements to understand the basic operation mode of the experimental platform are the following ones:



a) b)

Figure 2. a) Connectors' side; b) Dial side

In one of the lateral faces of the cube, 3 connectors can be found:

- J1, power supply: shall be connected to 12Vcc.
- J2, usb-c type: to connect the platform to the computer.
- J3, usb-b type: only for programming purpose (not required).

In the top face of the cube, you can find a dial which function is to indicate to the user the actual position of the angular pose of the output shaft.

To carry out the practice lessons you only need to connect connectors J1 and J2, and manually move the dial to 0º.

2 App description

When launching the app for managing the platform a two layers interface will appear (see Figure 1).

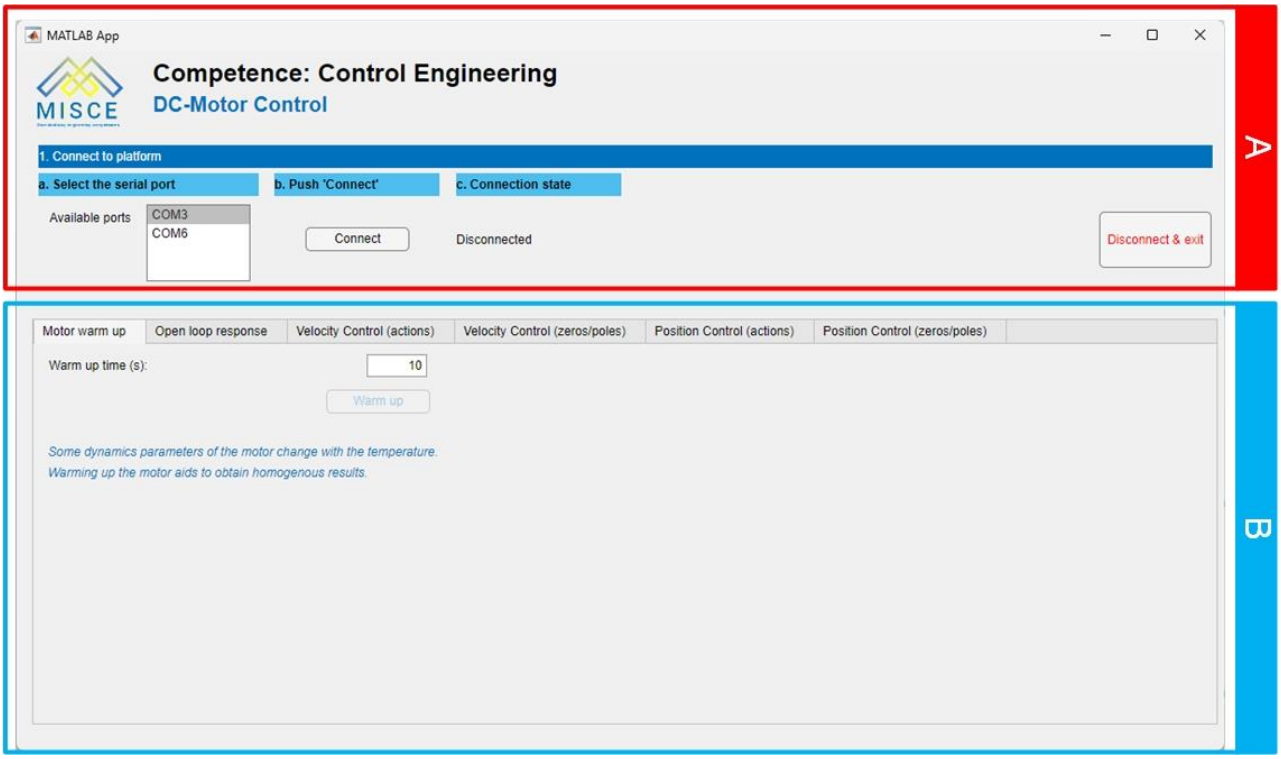


Figure 3. Overall view of the DC-Motor Control app

In layer A (in the top) the proper serial port must be selected and click on ‘connect’. When the connection to the platform is established the connection state will change to ‘connected’.

At any time, if user want to exit to the application, the ‘Disconnect & exit’ bottom must be pushed.

Layer B (in the bottom) has 6 tabs which correspond to 6 different operation modes that are detailed in the following sections.

2.1 Operation mode 1: Motor warm up

Some of the dynamic parameters of a DC-motor can suffer changes with the temperature. In this way, this operation mode is devoted to warm up the motor making it running during a specific time (see Figure 4).

Procedure:

1. Define 'Warm up time (s)' in seconds, e.g. 20 seconds.
2. Click on 'Warm up' button.

Result:

The shaft of the DC motor will rotate at maximum velocity during the specified time increasing its temperature[1].

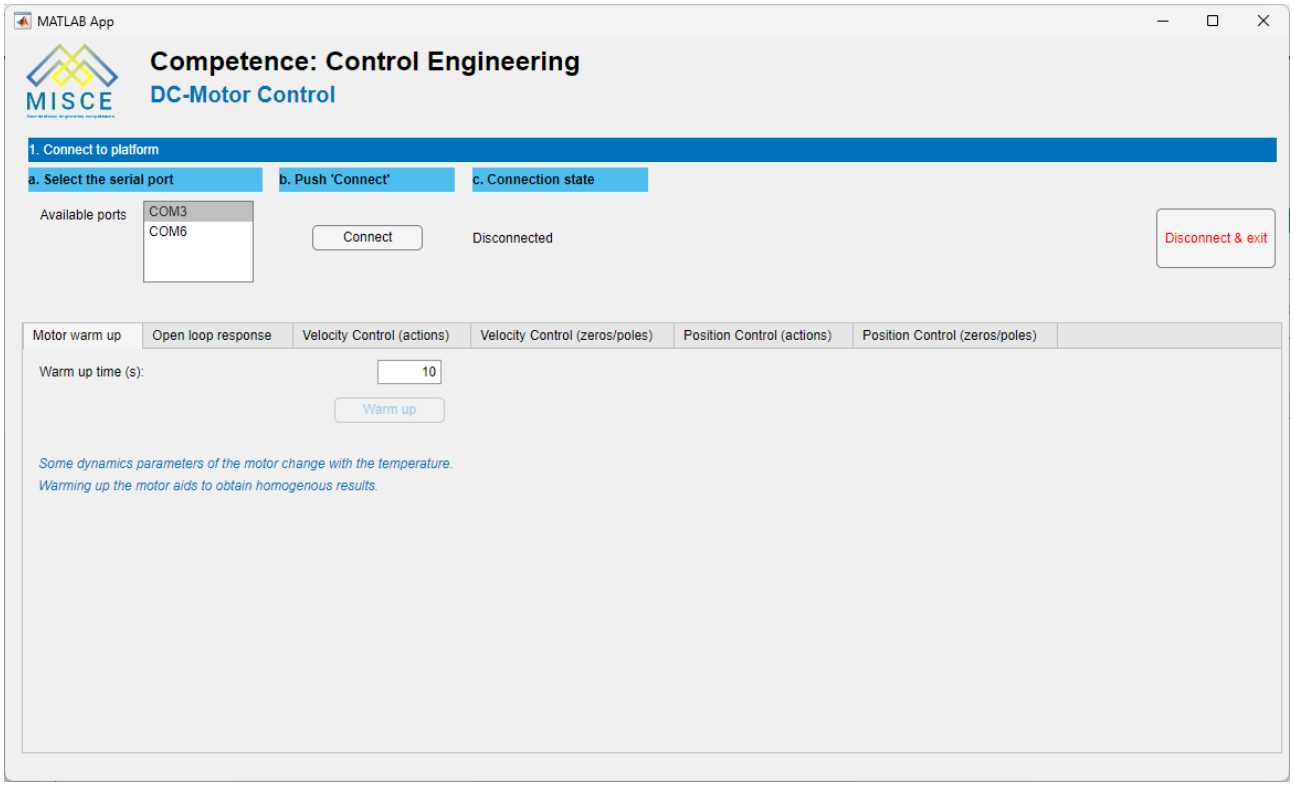


Figure 4. Operation mode 1: Motor warm up

[1] Note: It is recommended to warm the motor up during 20 or 30 seconds prior to the identification procedure and the velocity or position control (operation modes 2,3,4,5 and 6).

2.2 Operation mode 2: Open loop response

To understand this operation mode is necessary to carefully read the document Guide Notes 1. Motor identification.

The screenshot of this operation mode is shown in Figure 5.

Procedure:

1. Define ‘Experiment time (s)’ in seconds, e.g. 10 seconds.
2. Define ‘Input Voltage (-12, 12) V’, e.g. 6 V.
3. Click on ‘Execute’ button.

Result:

The DC motor will be excited with a step voltage of 6 V (example) and after the experiment time, its velocity response will be represented in the Figure at the right.

Clicking on ‘Save open loop results’ the user can save the experimental results in a text plain file with the following format in 4 columns:

```
1)Time(s) | 2) Input Voltage(V) | 3) Velocity(rad/s) | 4) Filtered Velocity(rad/s)
```

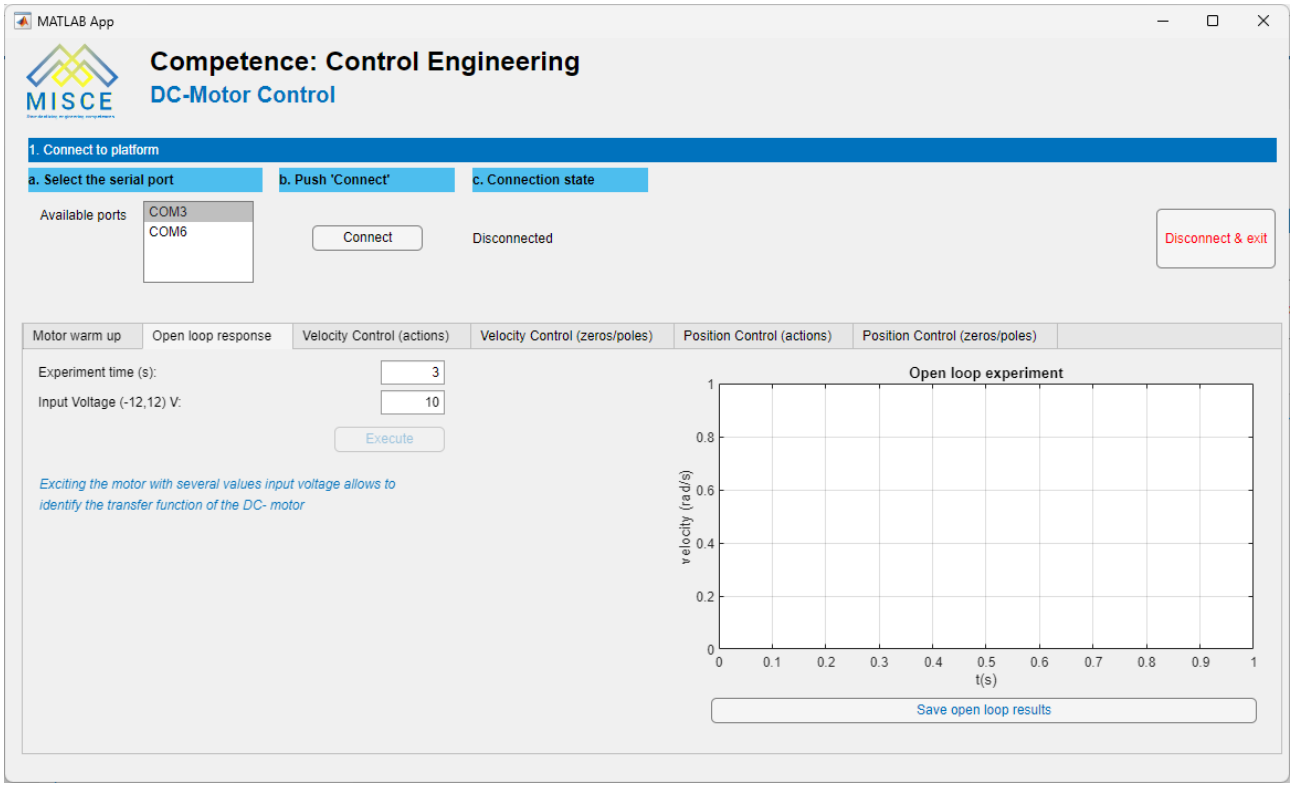


Figure 5. Operation mode 2: Open loop response

2.3 Operation mode 3: Velocity control (actions)

To understand this operation mode is necessary to carefully read the document Guide Notes 2. Velocity control.

The screenshot of this operation mode is shown in Figure 6.

Procedure:

1. Define 'Experiment time (s)' in seconds, e.g. 10 seconds.
2. Define 'Velocity reference (rad/s)', e.g. 10 rad/s.
3. Define the parameters of the PID controller, K_p, K_i and K_d
4. Click on 'Execute' button.

Result:

The DC motor will be controlled in velocity with the specified PID controller and the defined velocity reference and after the experiment time, its velocity response will be represented in the Figure at the right.

Clicking on 'Save open loop results' the user can save the experimental results in a text plain file with the following format in 4 columns:

```
1)Time(s) | 2) Input Voltage(V) | 3) Velocity(rad/s) | 4) Filtered Velocity(rad/s)
```

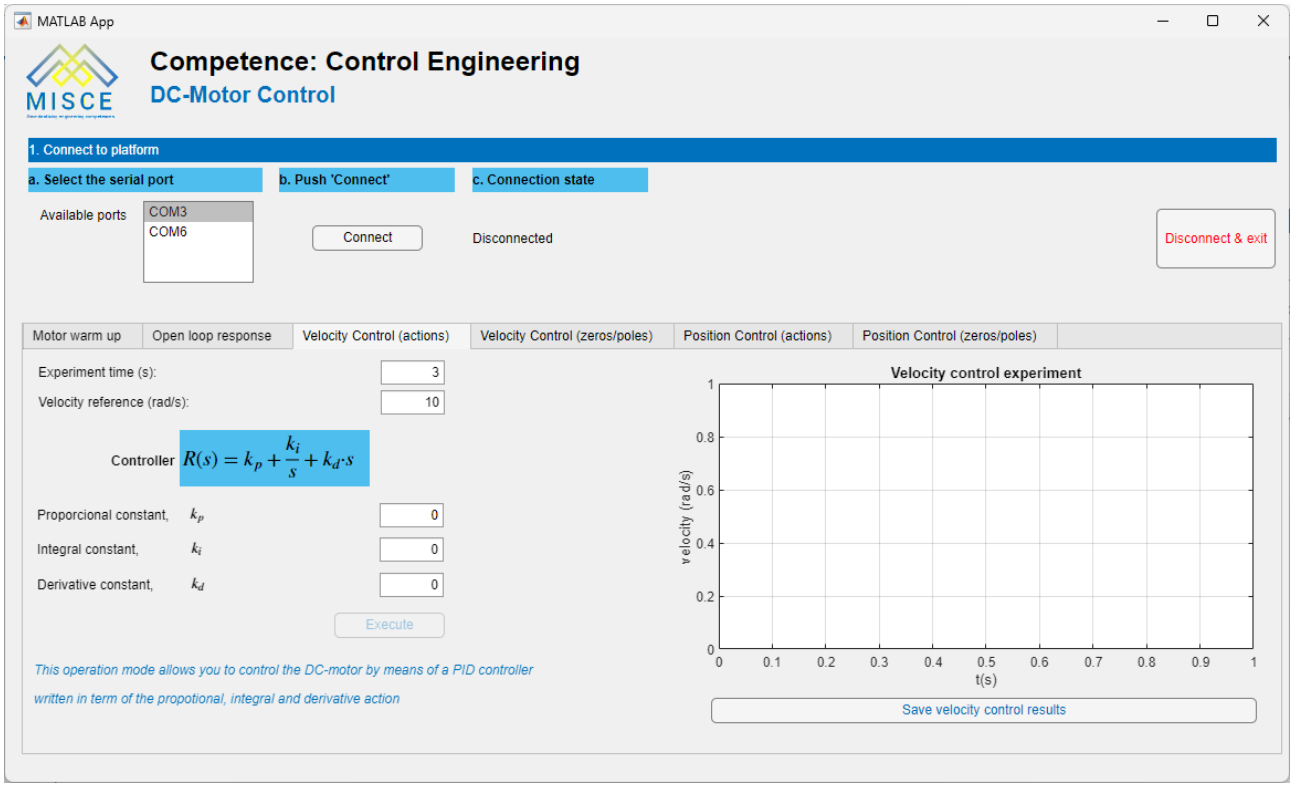


Figure 6. Operation mode 3: Velocity control (actions)

2.4 Operation mode 4: Velocity control (zeros/poles)

To understand this operation mode is necessary to carefully read the document Guide Notes 2. Velocity control.

The screenshot of this operation mode is shown in Figure 7.

Procedure:

1. Define 'Experiment time (s)' in seconds, e.g. 10 seconds.
2. Define 'Velocity reference (rad/s)', e.g. 10 rad/s.
3. Define the parameters of the PID controller, k, c, p, c_i and p_i.
4. Click on 'Execute' button.

Result:

The DC motor will be controlled in velocity with the specified PID controller and the defined velocity reference and after the experiment time, its velocity response will be represented in the Figure at the right.

Clicking on 'Save open loop results' the user can save the experimental results in a text plain file with the following format in 4 columns:

```
1)Time(s) | 2) Input Voltage(V) | 3) Velocity(rad/s) | 4) Filtered Velocity(rad/s)
```

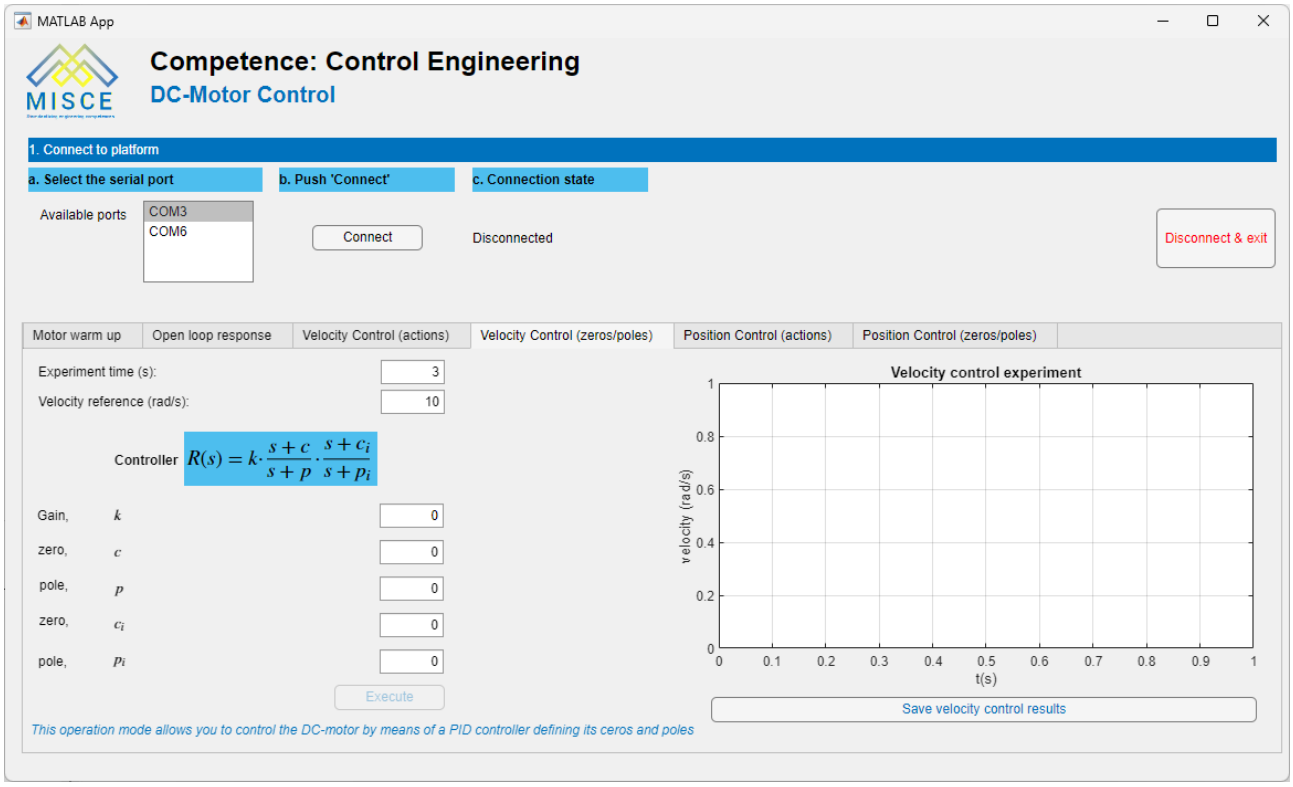


Figure 7. Operation mode 4: Velocity control (zeros/poles)

2.5 Operation mode 5: Position control (actions)

To understand this operation mode is necessary to carefully read the document Guide Notes 3. Position control.

The screenshot of this operation mode is shown in Figure 8.

Procedure:

1. Define 'Experiment time (s)' in seconds, e.g. 10 seconds.
2. Define 'Position reference (rad/s)', e.g. 1.57 rad.
3. Define the parameters of the PID controller, K_p, K_i and K_d.
4. Click on 'Execute' button.

Result:

The DC motor will be controlled in position with the specified PID controller and the defined position reference and after the experiment time, its position response will be represented in the Figure at the right.

Clicking on 'Save open loop results' the user can save the experimental results in a text plain file with the following format in 4 columns:

```
1)Time(s) | 2) Input Voltage(V) | 3) Position (rad) | 4) Filtered Position(rad)
```

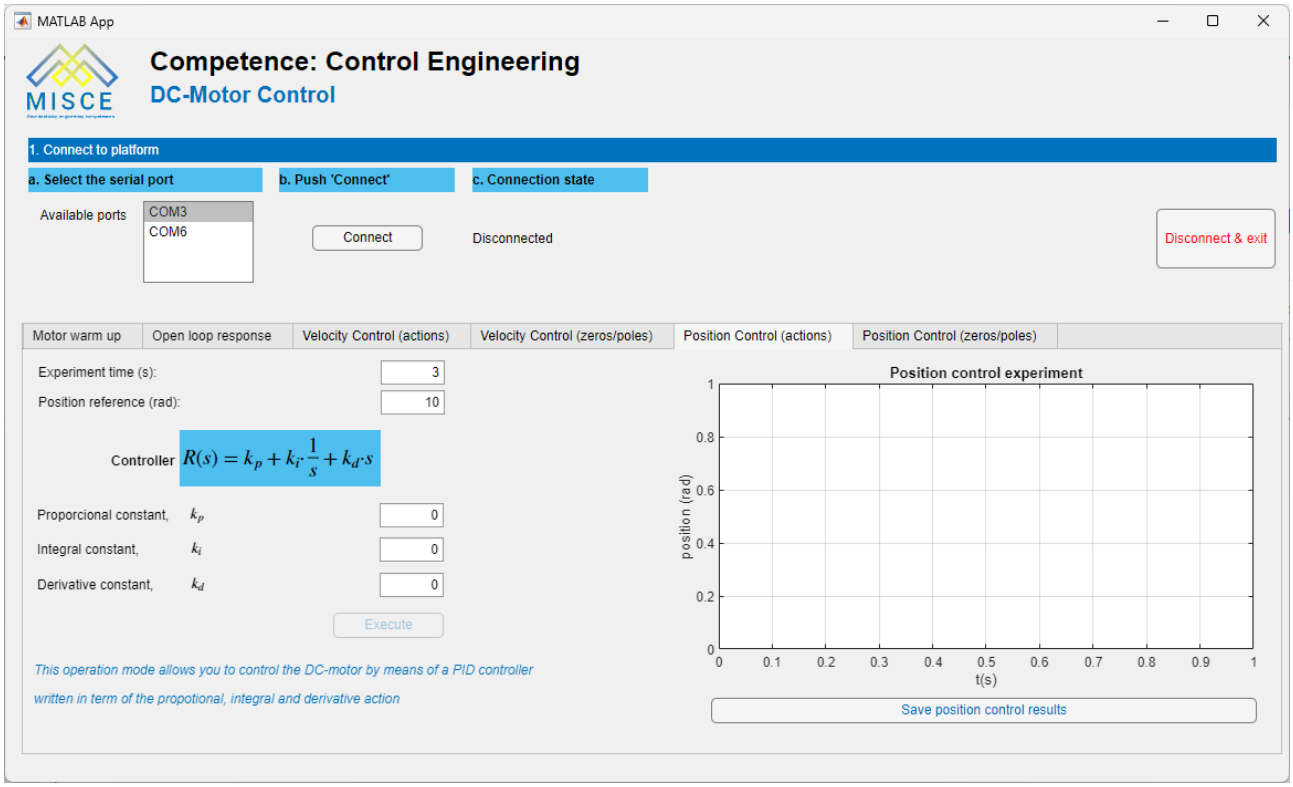


Figure 8. Operation mode 5: Position control (actions)

2.6 Operation mode 6: Position control (zeros/poles)

To understand this operation mode is necessary to carefully read the document Guide Notes 3. Position control.

The screenshot of this operation mode is shown in Figure 9.

Procedure:

1. Define 'Experiment time (s)' in seconds, e.g. 10 seconds.
2. Define 'Position reference (rad/s)', e.g. 1.57 rad.
3. Define the parameters of the PID controller, k, c, p, c_i and p_i.
4. Click on 'Execute' button.

Result:

The DC motor will be controlled in position with the specified PID controller and the defined position reference and after the experiment time, its position response will be represented in the Figure at the right.

Clicking on 'Save open loop results' the user can save the experimental results in a text plain file with the following format in 4 columns:

```
1)Time(s) | 2) Input Voltage(V) | 3) Position (rad) | 4) Filtered Position(rad)
```

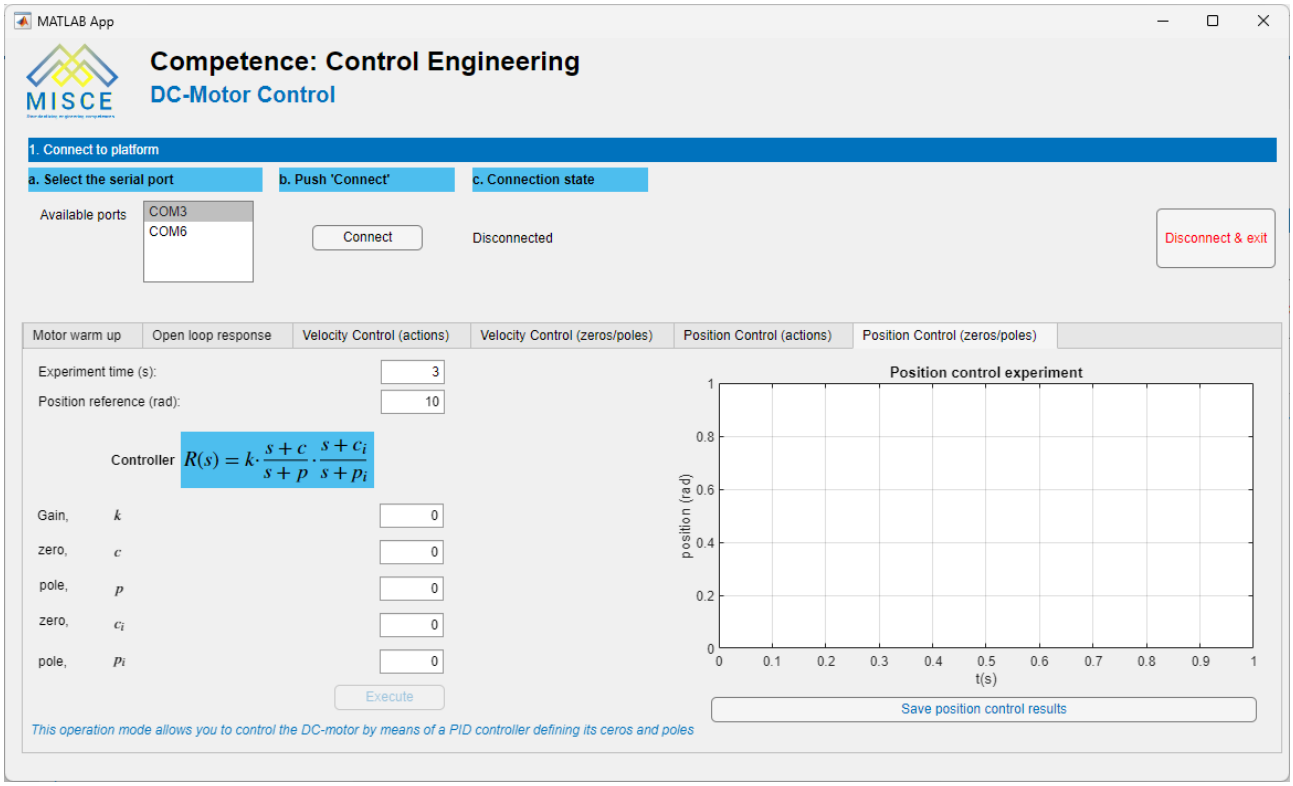


Figure 9. Operation mode 6: Position control (zeros/poles)