Automatic Control

Experimental laboratory procedure

Preliminary steps

It is necessary to perform the design procedure before coming to the laboratory. The transfer function of the obtained C(z) must be saved from the MATLAB® environment on a USB drive as:

```
>> [ncd,dcd]=tfdata(Cd,'v');
>> save Tf_ascii ncd dcd -ascii
```

The order in which variables are saved is important! Please follow this template!

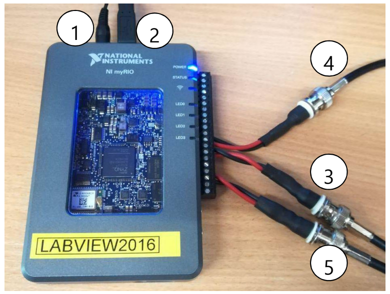
The physical system will be controlled by means of a NI MyRIO® board, that implements the digital controller C(z).

The performance of the designed control system will be evaluated by means of the following tests:

- response of the system to a **square wave $r_1(t)$** of peak-to-peak amplitude **V_{pp}=0.5V**, frequency **f=0.1Hz**, duty cycle **D=50%**;
- response of the system to a **sawtooth wave $r_2(t)$** of peak-to-peak amplitude **V_{pp}=0.5V**, frequency **f=0.1Hz**, duty cycle **D=50%**.

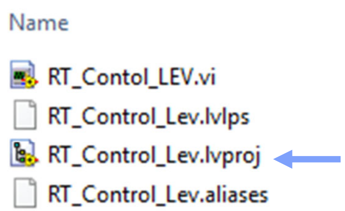
Detailed description of the laboratory procedure

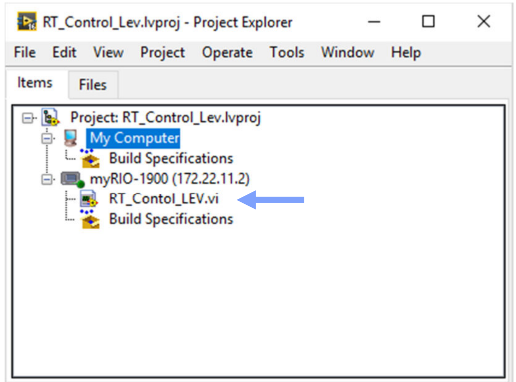
1. Login to one of the PC in the laboratory, to be able to use LabVIEW®.
2. Turn the magnetic levitator on, from the switch on the rear of the device.
3. Switch on the signal generator, and set it properly so that either $r_1(t)$ or $r_2(t)$ is generated.
4. Connect the MyRIO board to electricity (1), and to the PC (2).
   a. Connect the reference r(t) (output of the signal generator) to *Analog Input 0* (3), “Position Sense” at *Analog Input 1* (4), and “Command IN” at *Analog Output 0* (5) by means of BNC cables.



Detailed description of the laboratory procedure

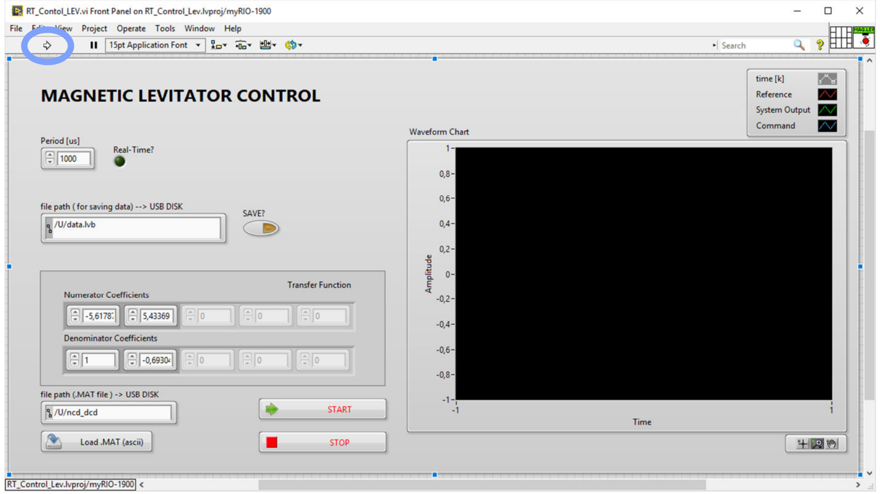
5. Open the LabVIEW 2016 project **RT_Control_Lev.proj;** therefore, open the file **RT_Control_lev.vi**, under the target *MyRIO-1900.*





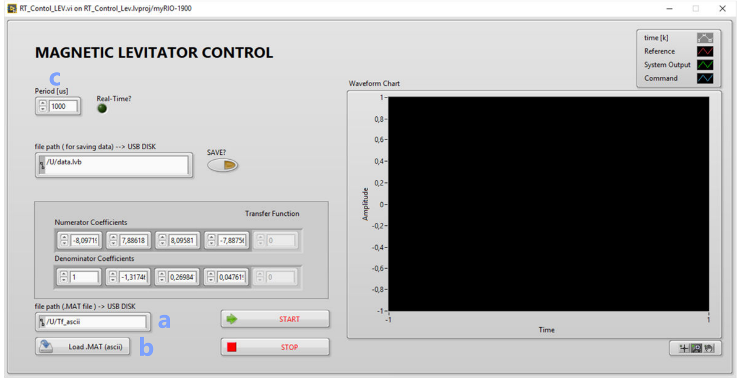
Detailed description of the laboratory procedure

6. Start the program by clicking on the (encircled) withe arrow on the top left side.



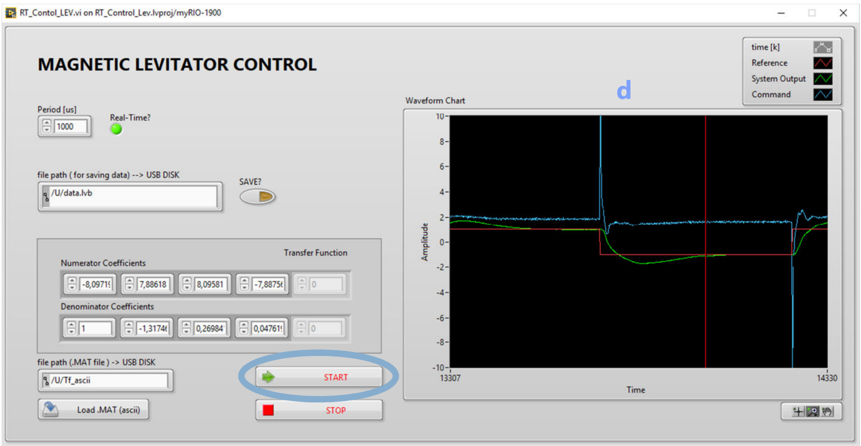
Detailed description of the laboratory procedure

7. Upload the coefficients of C(z): insert a USB drive containing the previously generated ASCII file, in the **proper port of the MyRIO board**, type its path in (a) as "/U/Filename" and click on (b).
8. Set the sampling period in (c), expressing it in μs.



Detailed description of the laboratory procedure

9. While keeping the mass in correspondence to the mid-point **of the position transducer** (to avoid the reaching of the saturation limit for u(t)), switch the control loop on by clicking on ***Start***. The signals can be visualised in (d).



Detailed description of the laboratory procedure

10. The data can be saved by clicking on *SAVE* (e). Saving can be interrupted by clicking again on (e). The output file is stored on the **USB drive** that was previously inserted on the board, and its name can be specified in (f) as */U/Output_name.lbv*, and it will contain four columns: time, expressed in number of samples, r(t), y(t), u(t).