

Electronically Assisted Pedal Board for Lower Limbs Rehabilitation

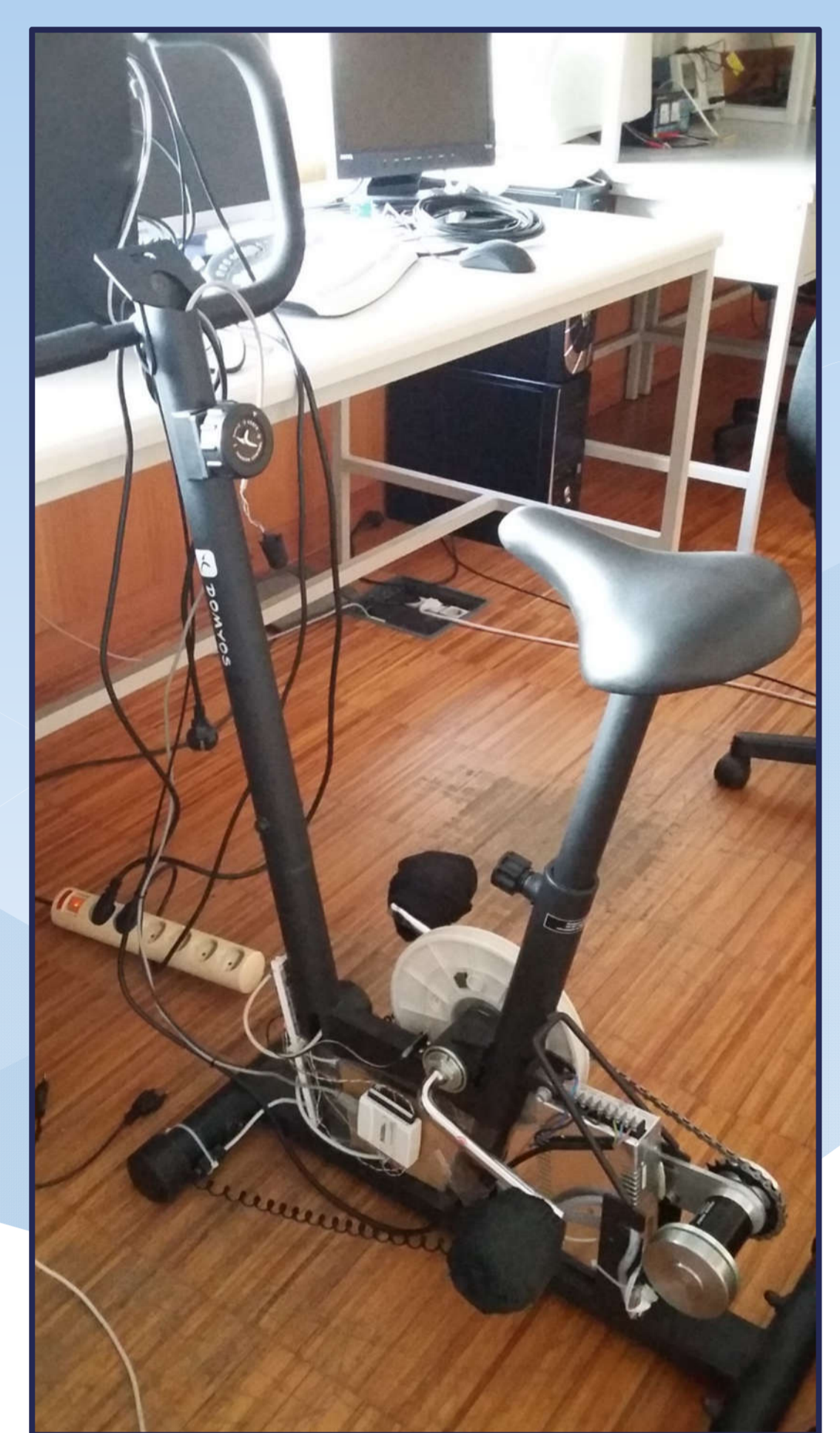
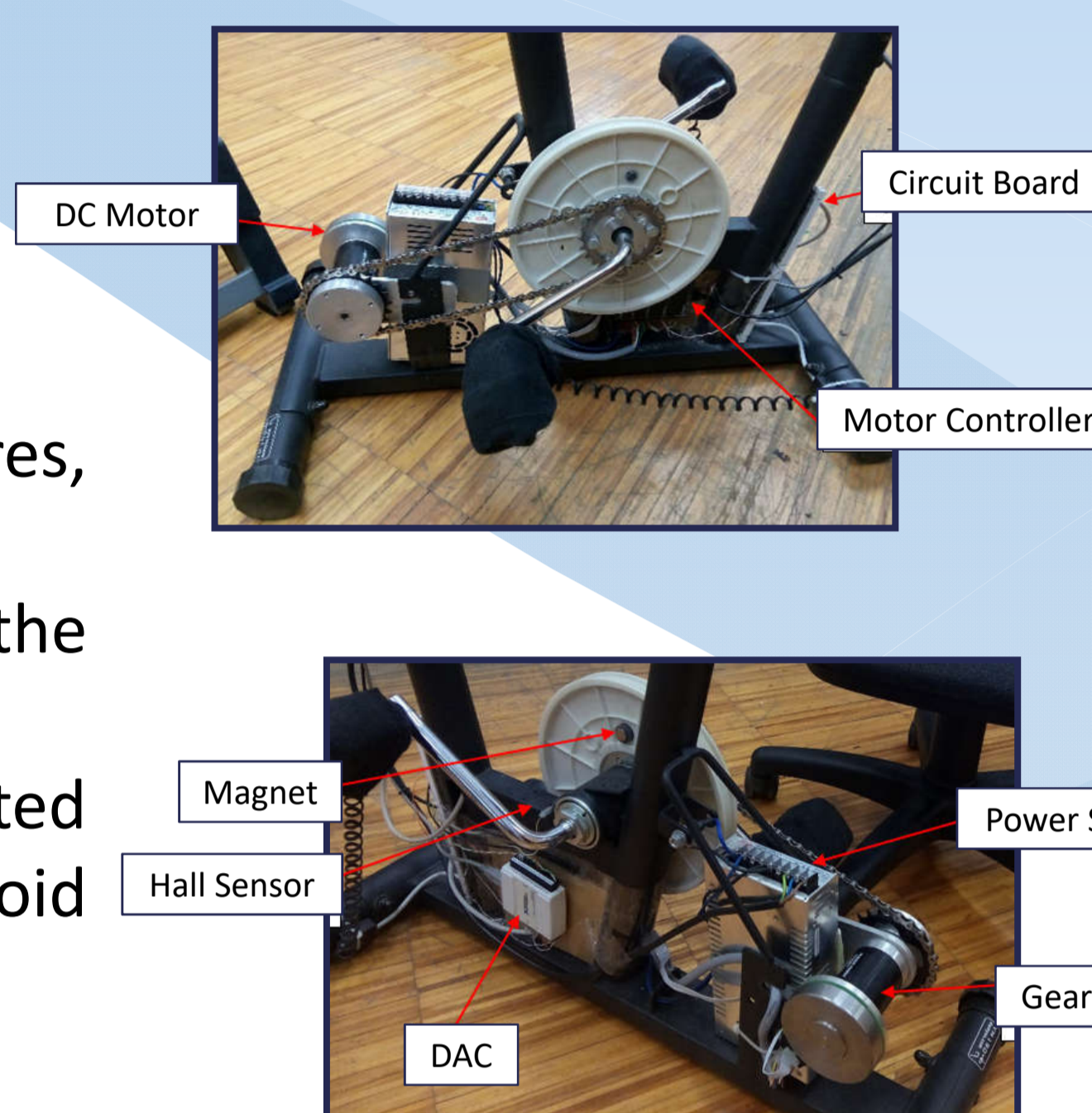
Introduction

The lower limbs allow us to move naturally, performing an essential role in the quality of life and the well-being of humans. Nevertheless they are repeatedly harassed by various pathologies that end up by damaging the agility of the movement.

This device is dedicated to rehabilitation and maintenance, and in this field the range of possible applications is enormous.

Some of the most commons applications are for:

- Aged people;
- People who have suffered a stroke;
- People that need recovery from muscle ruptures, tendinitis, arthrosis, bursitis;
- People that need help in the recovery of the movements, for instance due to long periods in bed;
- People that have rheumatologic disorders associated with inflammatory pathology, such as rheumatoid arthritis and psoriatic arthritis;
- People that need post operative rehabilitation.

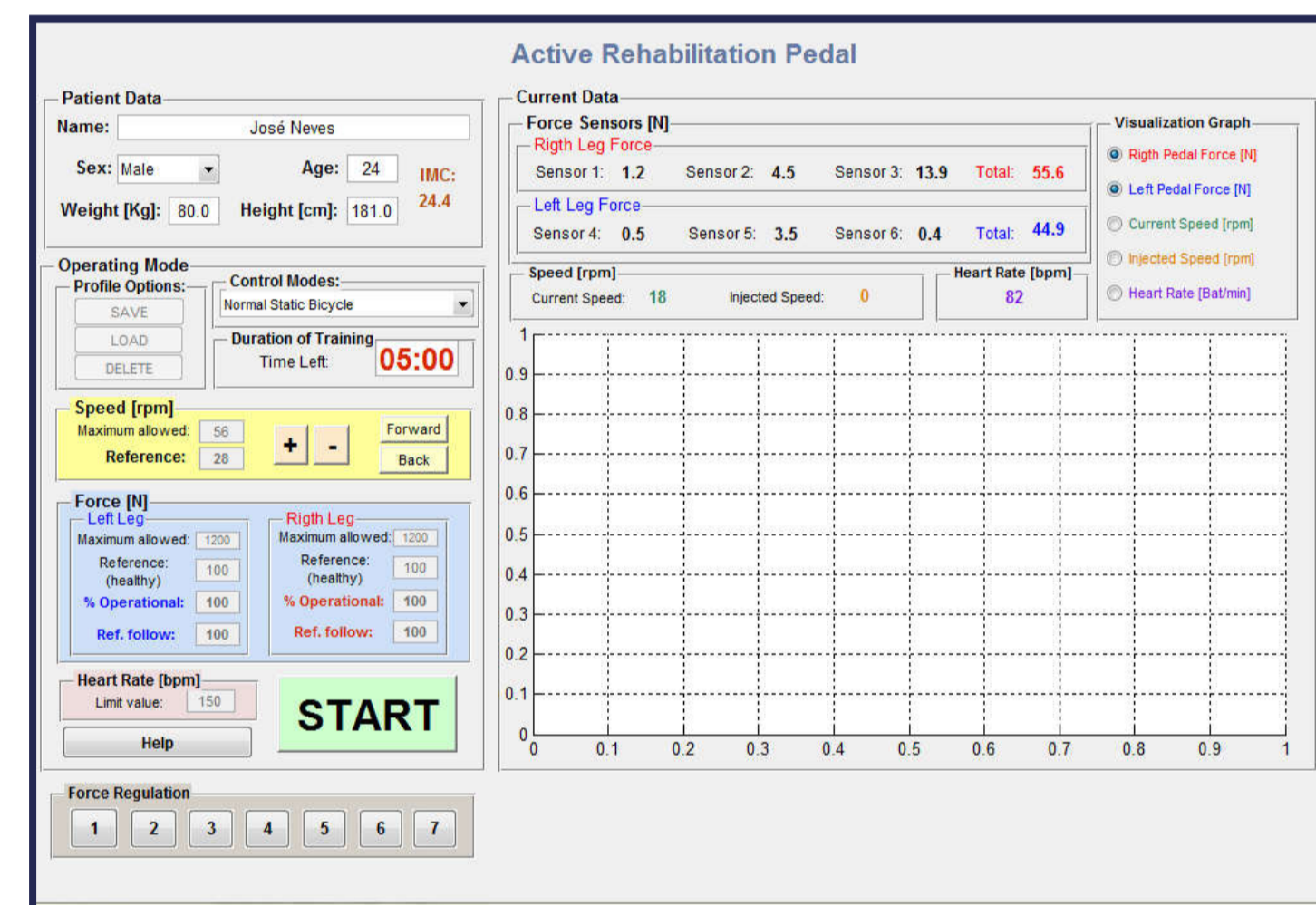


Electronically Assisted Pedal Board.

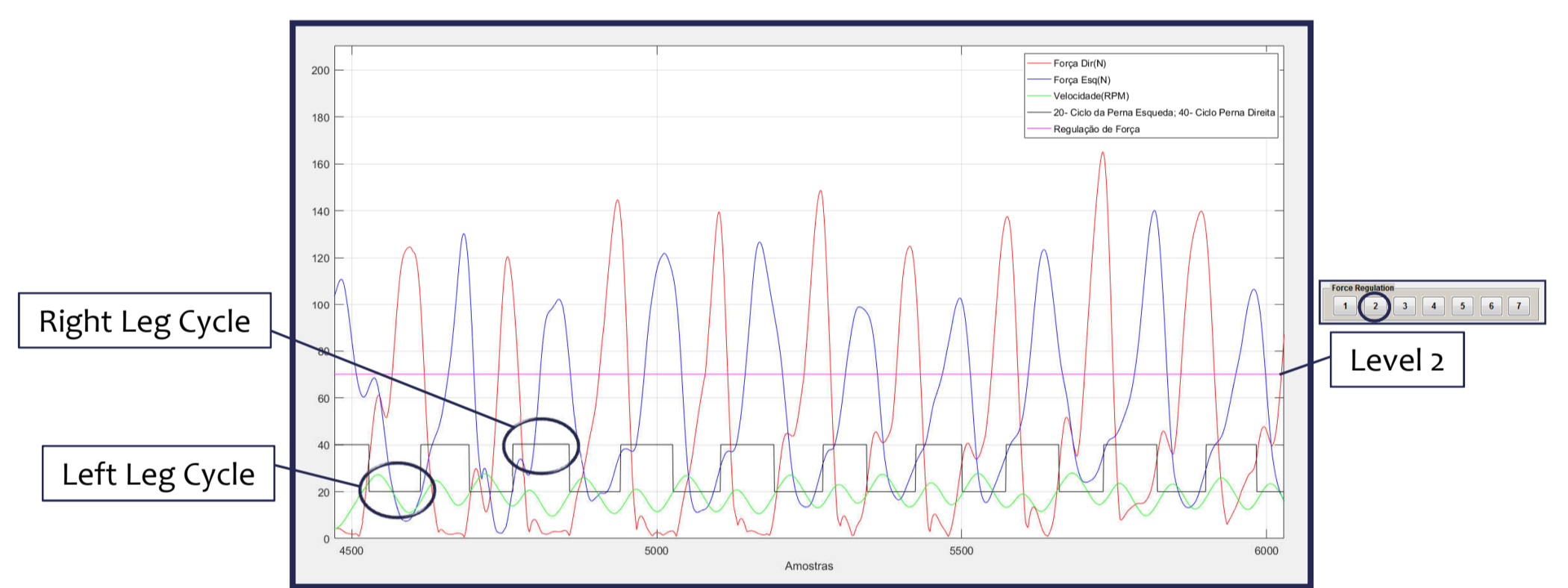
Operational Modes

The user can select different modes of operation:

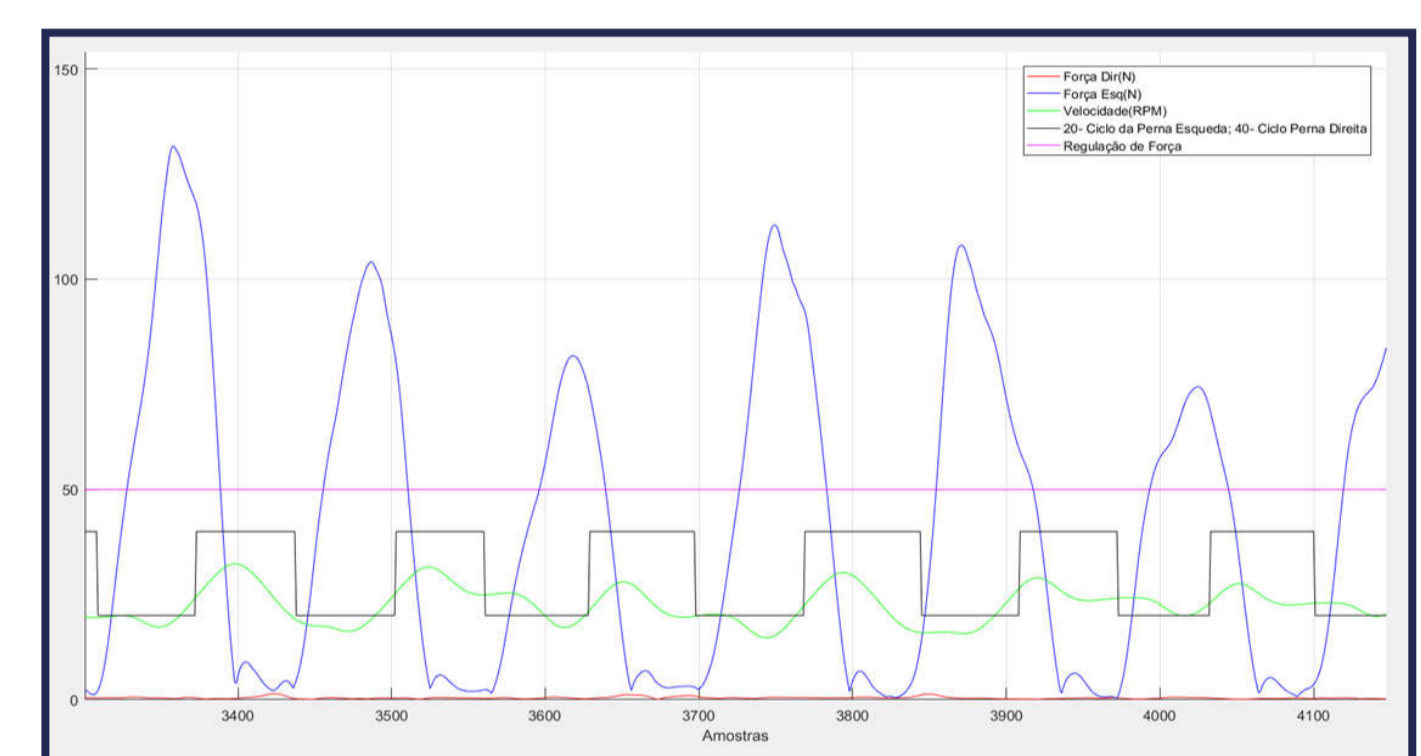
- Normal Static Bicycle
- Weakened Leg
- Calibration
- Muscle Stimulation
- Constant Speed
- Settings



Interface Layout.



Normal Static Bicycle Mode.



Weakened Leg Mode.

$$Velocity_{out} = |\sum Forces_{RightPedal} - Forces_{LeftPedal}| \times Force\ Regulator$$

$$Velocity_{compensation} = Velocity_{previousHalfCycle} \times (1 - Funcionality)$$

$$Velocity_{weakenedLegCycle} = Velocity_{compensation} + Velocity_{out}$$

In Development

Hardware:

- Additional magnets to improve precision in pedal position;
- Upgrade of the current electronic board;
- Generation and storage of electrical energy during pedaling that can be used, for instance, to charge smartphones.

Software:

- Simulation games (Tour de France);
- Detection of force differences between the two legs and display the percentage of functionality in a weakened limb;
- Display of distances covered in training and burned calories.

Acknowledgments

Fundação para a Ciência e a Tecnologia (FCT) and the COMPETE2020 program for the financial support to the projects UID-EEA-00048-2013 and PTDC/EEI-AUT/5141/2014.