ADMAS:
Steer-By-Wire System for Electratón car

Engineering Project

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CIMB
CENTRO DE INVESTIGACIÓN EN MICROSISTEMAS Y BIODISEÑO

Problematics

The Electraton car currently works with a mechanical steering system which hinders its maneuverability, a factor that represents a disadvantage. The weight of the vehicle, type of ground, type of tire and speed are factors that determine the force that the driver must apply on the steering wheel to be able to turn it to a desired angle.

General Objective

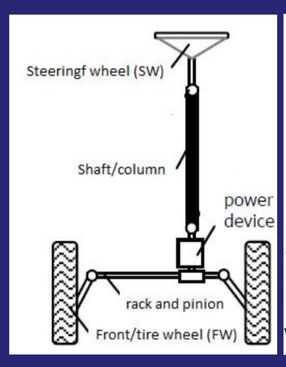
Design, build and implement in a testbed a steer-by-wire direction system for the Electraton team car.

Specific Objectives

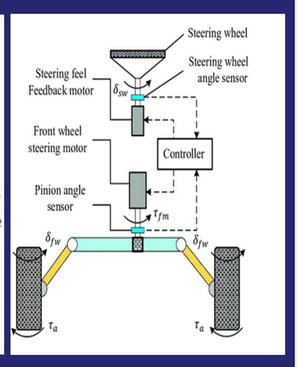
- Replicate the part of the vehicle of interest.
- Design the system's ability to send feedback (feedback) to the steering wheel.
- The system must tolerate and respond to disturbances.

Project proposal

Implement an electromechanical system by means of the steer-by-wire system (SBW) to improve the driving of the vehicle. The SBW system has competitive advantages over the conventional steering system and other assisted steering systems.

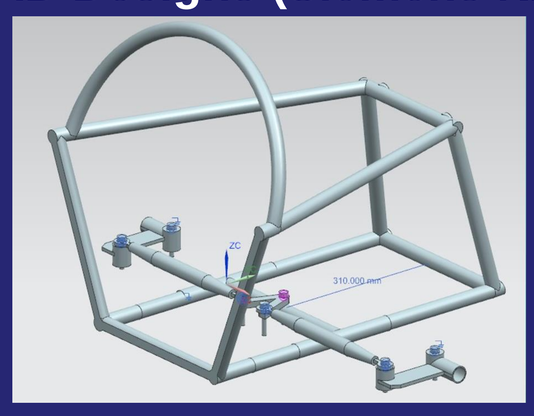


Mechanic system.

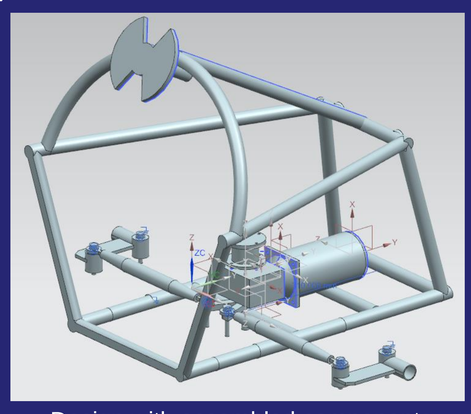


SBW system.

CAD Designs (Siemens NX 12)



Car front replica testbed with the mechanism.

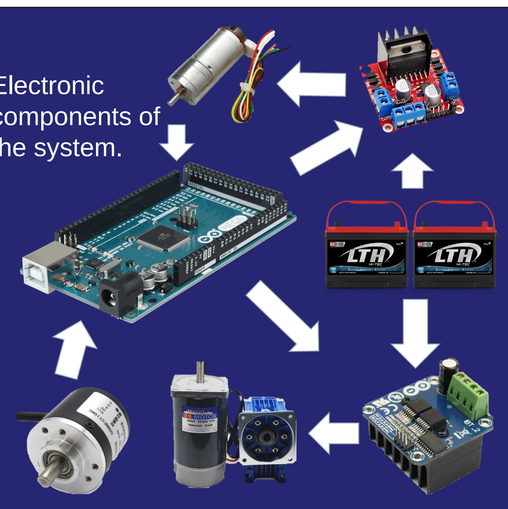


Design with assembled components.

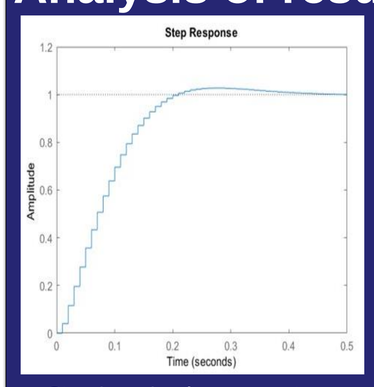
Development of the testbed

Testbed with mounted tyres.

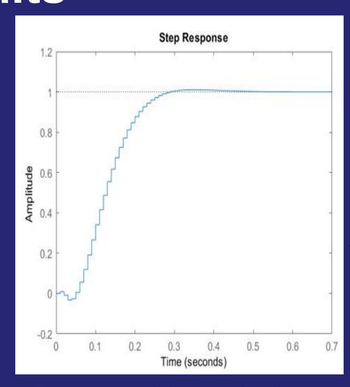
Electronic components of the system.



Analysis of results

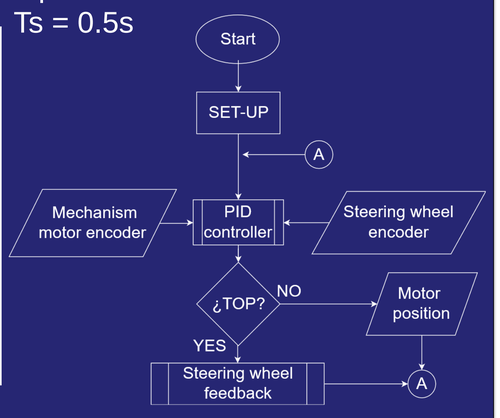


Steering wheel response to a step input.



Response of the mechanism motor to a step input.

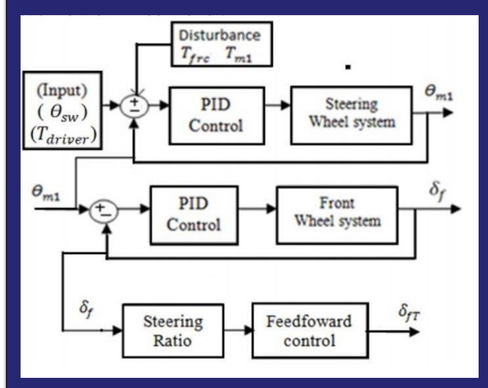
Mp = 4%
Ts = 0.5s

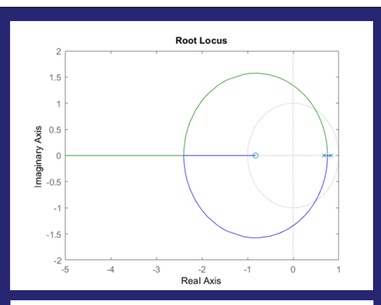


Program implemented in the microcontroller.

The control system was integrated with the mechanism in the test bench; the empty tests were carried out successfully.

System identification





Work in the future

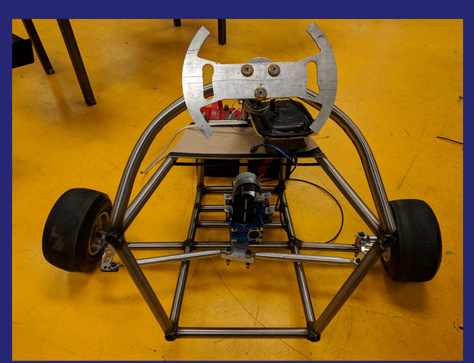
- Implementation of the system in the car of the team.
- Generate a fault-tolerant backup system.
- Generate the electronic acceleration and braking system.
- Operate the vehicle by remote and autonomous control.

Ethical dilemma

- Situation of system failure during the race.
- Race programming - semiautomatic driving.

Results:

Steering column mounted on the Electraton car.



Functional testbed with steer-by-wire system.

Conclusions

- It was possible to replicate the part of interest of the vehicle with the adequate dimensions.
- An analog PID controller with digital signals was implemented.
- The position of the rotating engine was controled with reference to the steering wheel encoder.
- The system was manufactured and integrated into a testbed.
- The correct functioning of the system without load was verified.

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