

Analysis and modeling of a vehicle through reverse engineering



Component
École Nationale
Supérieure
d'Électrotechnique
d'Électronique
d'Informatique
d'Hydraulique
et des
Télécommunications

In brief

- **Ametys Code:** ELP12
- **Open to exchange students:** No

Presentation

Objectives

This project aims to guide students in understanding, modeling, and analyzing the powertrain of an existing electric vehicle using a reverse engineering approach.

Upon completion of the project, students will be able to:

- Analyze a complex system (electric vehicle) by identifying its subsystems and their interactions.
- Decompose and model the powertrain: battery, drive unit, motor, transmission, and axles.
- Develop a comprehensive energy model of the vehicle (power balance, efficiency, estimated range).
- Use modeling and simulation tools (e.g., MATLAB/Simulink, Scilab/Xcos, or other equivalent software).
- Implement an experimental and validation approach: compare the model with real-world measurements.

Work collaboratively on a multidisciplinary technical project, documenting each step (analysis, modeling, validation, synthesis).

Description

The GOUPIL is a small electric utility vehicle used for industrial, municipal, and logistics applications. Its mechanical simplicity and 100% electric powertrain make it an excellent teaching tool for studying electromechanical and energy systems.

Students will begin their analysis by studying the vehicle and acquiring data from the OBD (on-board diagnostics) system.

They will then be tasked with modeling all the components of the powertrain, dividing the work into subgroups. They will thus need to apply their communication and organizational skills to compare their model with the existing vehicle, analyze the model, and propose potential improvements.

Pre-requisites

- Principles of static converter control
- Principles and models of electrical machines
- Machine/converter association