

## Control Strategy for a Solar Vehicle Race

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**Abstract :** Electrical vehicles are a solution for reducing the pollution using green energy. The shell Eco-Marathon provides rules in order to minimize the battery use for the race. The use of solar panel combined with efficient motor control and race strategy allow driving a 60kg vehicle with one pilot using only the solar energy in the best case. This paper presents a complete modelization of a solar vehicle used for the shell eco-marathon. This project called Helios is cooperation between non-graduated students, academic institutes, and industrials. The prototype is an ultra-energy-efficient vehicle based on one-meter square solar panel and an own-made brushless controller to optimize the electrical part. The vehicle is equipped with sensors and embedded system to provide all the data in real time in order to evaluate the best strategy for the course. A complete modelization with Matlab/Simulink is used to test the optimal strategy to increase the global endurance. Experimental results are presented to validate the different parts of the model: mechanical, aerodynamics, electrical, solar panel. The major finding of this study is to provide solutions to identify the model parameters (Rolling Resistance Coefficient, drag coefficient, motor torque coefficient, etc.) by means of experimental results combined with identification techniques. One time the coefficients are validated, the strategy to optimize the consumption and the average speed can be tested first in simulation before to be implanted for the race. The paper describes all the simulation and experimental parts and provides results in order to optimize the global efficiency of the vehicle. This works have been started four years ago and evolved many students for the experimental and theoretical parts and allow to increase the knowledge on electrical self-efficient vehicle.

**Keywords :** electrical vehicle, endurance, optimization, shell eco-marathon

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