A New Method to Calculate Electric Wheelchair Driving Cycles

Giulia Barbareschi [1] , Member, IEEE; Dan Brett [2] ; Catherine Holloway [1] , Member, IEEE

[1] University College London Interaction Centre, London, United Kingdom
[1] University College London Electrochemical Innovation Lab, London, United Kingdom

Rationale

- Most electric wheelchairs are still equipped with deep discharge lead acid batteries, which, due to both high weight and size represent a limiting factor in design
- Alternative power sources have recently attracted great interest due to characteristics such as instant recharging time, low weight and hybridization possibilities
- To select and design power sources for electric vehicles it is important to estimate the power demand under the different conditions encountered during general use

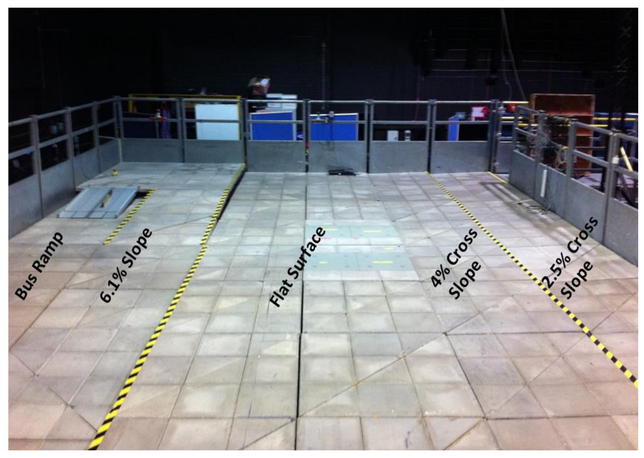
Monitoring real life driving cycles can allow us to design and select power sources specific to the individual needs

Background

- Driving cycles express the variation of speed over time of a vehicle during standard use
- In the automotive industry driving cycles are commonly used to estimate vehicles fuel consumption and emission
- To offer an accurate representation several environmental conditions need be included
- A solution to this is offered by the use of a microtrip approach, where data from single conditions can be combined into a complex cycle

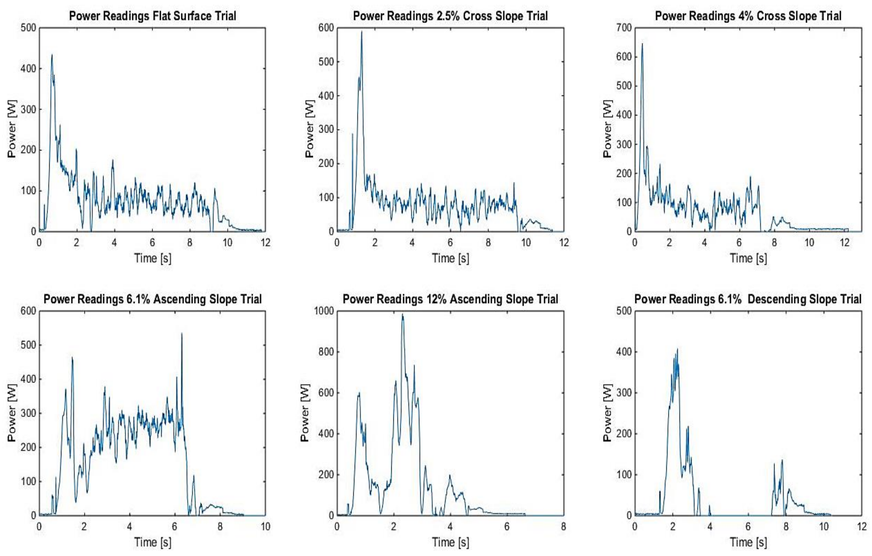
Methods

- Six different driving conditions of various lengths: Flat surface, Cross falls, Ascending and Descending Slopes, Bus Ramp
- Invacare Typhoon II powered wheelchair with custom made unit measuring voltage, current and wheel rotational speed
- Eight able bodied subjects with no wheelchair experience, aged between 22 and 47 years
- Each task was recorded 3 times, mean and peak power values across subjects were used as target values
- For each condition the trial that approximated the target values more closely was chosen as representative

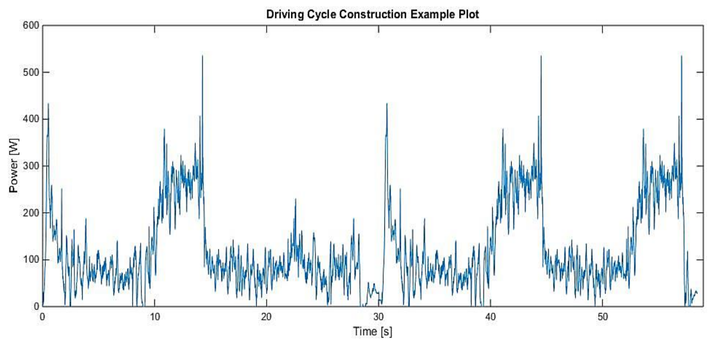


Results

- Four trials show a high peak of power consumption at the beginning of the trial, needed to overcome the inertia of the wheelchair, followed by a significantly lower and steadier power while the vehicle is travelling.
- Instead the two tasks involving the ascension of a longitudinal slope show two separate peaks of power.



We trimmed power readings to identify three phases of the wheelchair movement: initial acceleration, steady state and stop. An example of a short driving cycle was computed by combining a random series of different microtrips. Conditions included in this representation are flat surface, 2.5% cross slope, 4% cross slope and 6.1% ascending slope



UCL ENGINEERING Change the world

electrochemical innovation lab

UCLIC

Power-Up!