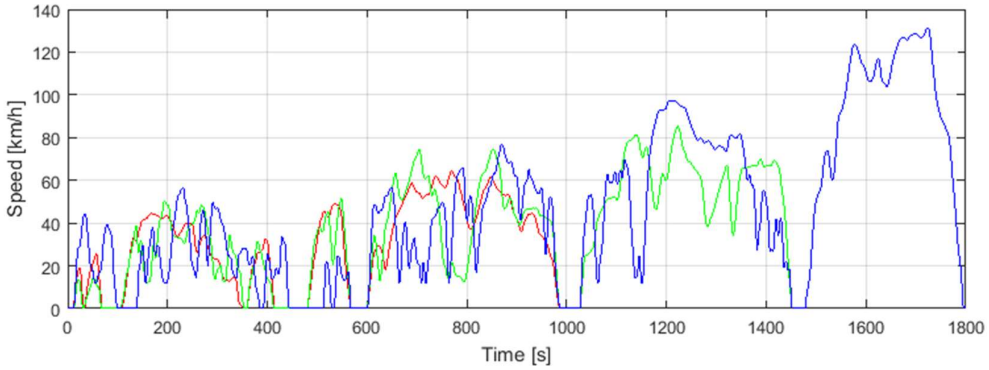
Assignment 1 in the course “Electric and Hybrid Electric Vehicles”, fall 2020

Power, Roll and Drag dependence of the fuel consumption with WLTP

Introduction

- To increase the pressure on the automotive industry to make cars that consume fuel and emit emissions in accordance with the datasheets, a global standard driving cycle is created called the WLTP (**W**orld harmonized **L**ight duty vehicle **T**est **P**rocedure).



- The WLTP driving cycle is divided into four parts with different average speeds: low, medium, high and extra high. Each part contains a variety of driving phases, stops, acceleration and braking phases. The cycle exist in three Classes with increasingly higher average speeds. A vehicle is generally assigned to a Class based on the “Power-to-Weight”-ratio[1] (PWr) [Watt/kg]. The classes are:
    - Class 1 - low power vehicles with PWr <= 22. (red in the figure)
    - Class 2 - vehicles with 22 < PWr <= 34. (green in the figure)
    - Class 3 - high-power vehicles with PWr > 34. (blue in the figure)
- The intention with this assignment is to evaluate how the engine power affects the fuel consumption (we cannot evaluate emissions that are a part of the purpose with WLTP). While you are at it, you will also evaluate how the Drag coefficient and the Roll Coefficient influence the results.

The assignment

1. Work alone or in groups of two. The purpose of this assignment is that you shall get well acquainted with the simulation model as a preparation for a later assignment, so it is important that you engage in the task.
2. Make yourself familiar with the “Conventional” simulation model.

[1] https://en.wikipedia.org/wiki/Worldwide_harmonized_Light_vehicles_Test_Procedure

3. Use the predefined car model and prepare to run a study where you vary the engine power (Pmax) in the interval [40…140 kW], the drag coefficient (C_d) in the interval [0.25 … 0.35] and the roll coefficient (C_r) in the interval [0.005 … 0.015].
4. Make sure that the right Class of driving cycle (according to the above) for each power level is selected depending on the vehicle power.
5. Plot the fuel consumption as a function of engine power and use C_d and C_r as parameters, i.e. plot the fuel consumption as a function of engine power for e.g. the different C_d values you have chosen in the one diagram and for the different C_r in another.
6. Write a short report presenting your conclusions on the results you find. Do the C_d and C_r influence the (relative) fuel consumption differently for different vehicle classes? Any other conclusions?
7. Submit the report by e-mail to Meng Lu (meng.lu@iea.lth.se) no later than Monday September 23rd. Use the filename "student1_student2_assigment1…". The report must be complete including front page and table of contents, all in one file. The report must be in "pdf" or Microsoft Word format. Pdf is preferred.