Final report SHC project

T4:3 Analysis of Formula 1 hybrid powertrains

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Summary

Understanding a Formula one hybrid can be important for hybrid power train engineers, as they are very different than the hybrid powertrains used in conventional cars and heavy vehicles and, therefore, can reveal new interesting insights and ideas.

Downsized turbocharged engine are becoming common in road cars to cut the emission and reduce fuel consumption. From 2014, formula one has started to use downsized turbocharged engine with rather strong hybridisation. The regulations imposed by the FIA on the amount of fuel used per race forces the teams to be more energy efficient and at the same time deliver a good performance fit for racing.

This project has done a literature study and a deeper analysis of some of the main solutions used in hybrid Formula 1 cars in 2014. The project was done in May and June 2014.

The analysis shows some solutions which may be interesting for road vehicles, like the electric turbocharger which is used both to reduce the turbolag as well as to regenerate some energy from the exhaust system.

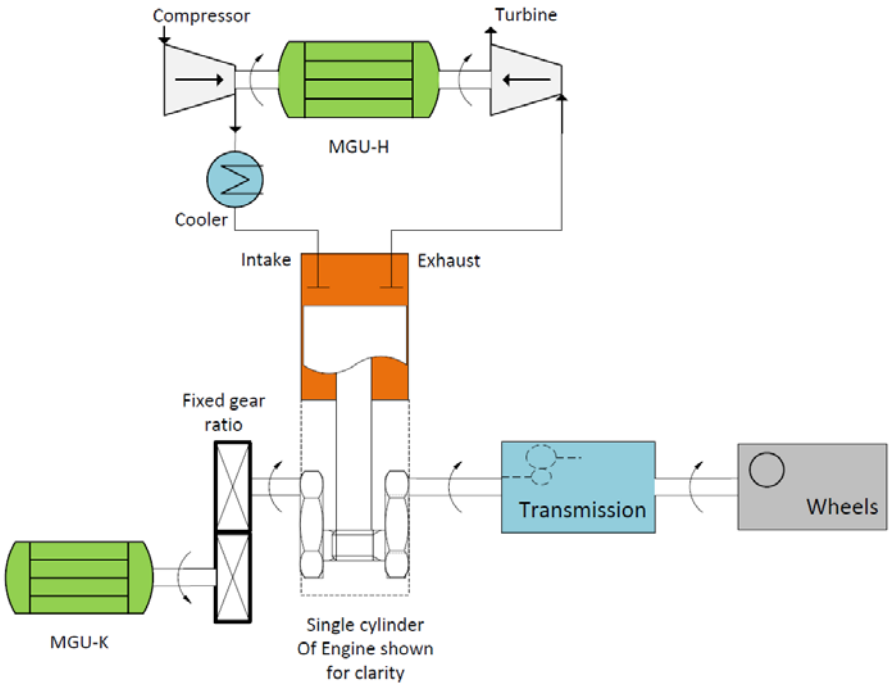
General project description and background

This project analysed the technologies used in Formula1 hybrid race cars, to understand in what way a hybrid powertrain designed for such a vehicle is different or similar to a hybrid powertrain in a conventional car. The technology used in F1 may show functionality which will later be used also in normal cars.

Achieved results

Although the energy recovery potential by using electric machine mounted on common shaft with the turbocharger is less when compared to other thermal energy recovery methods (such as Rankine cycle), its compactness and the ability to also reduce turbolag makes it an attractive solution for formula one cars , and probably also for future premium cars.

Addition of any energy recovery device in the exhaust path increases the exhaust back pressure which in turn influences the gas exchange process inside the cylinder. The same phenomenon is seen with recovering the energy from the exhaust gases using the electric turbo (MGU-H) in formula one car. It is learnt that, although it deteriorates the engine performance, the amount of energy recovered is higher and thereby improves the efficiency of the engine. It is confirmed that the fuel economy can be improved by 5-10% in diesel engines, but its potential to reduce the fuel consumption in gasoline engine is not clear yet and still needs to be analysed.



Hybrid powertrain used in F1 cars in 2014

Timing and finance

The project was run between May and June 2014 and has, through literature study and comparisons between F1 hybrid and other powertrains, described the technologies used in F1 hybrids and analysed their potential for conventional vehicles.

The total project budget is SEK 100’000 SEK, all of which is funded by SHC.

Executors and collaboration

The literature study, analysis and report in this project has mainly been done by Karthik Upendra. Anders Grauers and Victor Judez also has contributed to the analysis.

Dissemination of Results

The results have been presented for the vehicle analysis steering group and the report is available on the SHC web page.
http://hybridfordonscentrum.se/en/project/analysis-of-2014-formula-one-hybrid-a-preliminary-study-with-focus-on-its-applicability-to-road-cars/

It is also planned to communicate the results in the OMEV newsletter during mid 2015.

Papers and publications

Analysis of 2014 Formula one hybrid powertrain
- A Preliminary study with focus on its applicability to road cars
K Upendra, A Grauers, Chalmers University of Technology
SHC report, June 2014, 27 p.
http://hybridfordonscentrum.se/wp-content/uploads/2015/02/Analysis-of-2014-formula-one-hybrid-powertrain_ver1.pdf

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