LABORATOIRE D'ELECTROTECHNIQUE ET D'ELECTRONIQUE DE PUISSANCE DE LILLE

UNIVESRSITY OF GHENT

Co-supervised Master thesis, 2018-2019

— *Innovative Electric Variable Transmission for Trucks* —

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Context

Hybridization of vehicles with Internal Combustion Engines (ICE) is an interesting solution to reduce energy consumption and greenhouse gases emissions of transportation systems. The use of multiple energy sources (ICE, battery, etc.) combines advantages of each source to reduce the global energy consumption. However, the hybridization increases the complexity of Energy Management Strategies (EMS), which depends on technologies and architectures of hybridization. The "series-parallel" topology is the most interesting for automotive application. It is based on a simple planetary geartrain. However, this architecture cannot be considered for hybrid trucks due to mechanical constraints, which induce a prohibitive sizing. It should be noted that electric and hybrid electric trucks are in the roadmap of the ECGI (European Green Car Initiative of the H2020 program to face the challenge of our future mobility.

New innovative transmissions are currently developed for trucks, such as CVT (Continuous Variable Transmission), EVT (Electric Variable Transmission), and Double Planetary Geartrain (DPG). These new transmissions can improve hybrid electric vehicles allowing optimization of ICE operation to save more energy. The development of EMS, i.e. the distribution of energy within the vehicle, is a sensitive issue for these innovative transmissions.

Objective

University of Ghent (UGent) is developing a high-power EVT for various application including hybrid vehicles. UGent has already developed a scalable and validated model of an EVT with power electronics and control. University of Lille (ULille) is working on energy management of hybrid electric vehicles. The collaboration objective is to study the effectiveness of an EVT for hybrid electric trucks.

In short term, the models of the EVT-based hybrid trucks will be developed. As the sensitive element is EVT, a specific effort will focus on EVT modelling based on the expertise of UGent. Then an optimal EMS will be proposed off-line, based on the expertise of ULille. The potential fuel saving will be defined for standard driving cycles of trucks. In mid-term, the developed energy management will be validated on the EVT experimental set-up of UGent. A real-time energy management will be developed for different real driving cycles.

Work steps

Task 1 – September to February (simulation) – The Master student will be involved half-time on his Master thesis (due to the Master course). He will develop the model of the hybrid truck using the EVT, its control and a first EMS in simulation at ULille.

Task 2 – March to June (experimentation) – During his/her internship, the student will develop an optimal EMS at ULille and achieve experimental validation at UGent. A long stay is planned at UGent in that aim.

References

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