

STUDENTS' ANNUAL ACTIVITY REPORT

CYCLE XXXIV YEAR 2019/2020

- Name and Surname **Gulnora Yakhshilikova**
 - Dottorato in **INGEGNERIA MECCANICA**
 - Department **DIMEAS**
 - Coordinator **Prof. Luca GOGLIO**
 - Tutor **Prof. Andrea Tonoli**
 - Macroarea
Drivetrain design, Control strategy of HEV, Thermal modeling
 - Short description of research activity (maximum 20 lines)
 - ✓ In recent years, the research on economizing fuel consumption of vehicles has been interested due to the increased price of fuel and lowering greenhouse gas emission to the environment. In this way, Hybrid electric vehicles (HEVs) are regarded as an energy-saving solution in the vehicle industry. My research activity is mainly linked to partnership between Politecnico di Torino and Eldor company and the aim is to design and validate a new Integrated Hybrid Transmission (IHT) configuration having three energy sources: 2 Ems and an ICE for HEV system. Which allows to operate in both PHEV and SHEV modes, and can be driven in pure EV mode since ICE can be completely decoupled from electrical part. Moreover, it offers (provides) a novel solution for synchronization without use of frictional clutches and conical synchronizers. Last year, drive train design (shafts, gear, bearing, rack and pinion gears) and stress analysis had been implemented using KISSsoft software. Furthermore, preliminary Controller for Torque split strategy between 3 power sources for a given mode was designed. This Year we develop mode selection control strategy based on ECMS (equivalent fuel consumption minimization strategy). Obtained results showed that ECMS has about +10% of fuel economy with respect to conventional five speed vehicle having the same vehicle parameters. Then, for designing Controller including thermal limitation of electric devices, Full Lumped Thermal model of Ems, Inverters and DC/DC converters integrated with cooling system has been developed.

The following points have been addressed:

 - Checking the feasibility of IHT requirements
 - Transmission gearbox design
 - IHT vehicle model
 - Preliminary Torque split strategy
 - ECMS for mode decision and Torque split
 - Integrated Thermal model of ELDOR_IHT system

The current activities are:

 - Engine fuel enrich strategy during the transient
 - Training activities carried out during the year (courses, seminars, etc.); for each activity specify the nature, duration, and location
- Hard skills**
- | | |
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| Automotive transmissions (manual, non-manual and hybrid) (20h) | 30/01/2020 |
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- Possible participation in further research activities during the year (research projects and agreements)
- Eldor IHT project:

- ✓ Mode decision using ECMS (Laboratorio Interdipartimentale di Meccatronica and Eldor)
 - ✓ 2D Lumped Thermal modelling of Ems, Inverters and DC/DC converter (Laboratorio Interdipartimentale di Meccatronica and Eldor)
 - ✓ Helical Cooling jacket design for Ems, Heatsink design for Inverters and DC/DC converter (Laboratorio Interdipartimentale di Meccatronica and Eldor)
 - ✓ Engine fuel enrich strategy during transient operation (Laboratorio Interdipartimentale di Meccatronica and Eldor)
- Collaborations with companies during the year
 - ✓ Eldor company: within the scope of the doctoral theme
- List of accepted papers
 - Preparing 3 papers for publication:
 - ✓ Powertrain Configuration: Novel Integrated Hybrid Transmission for Power split
 - ✓ Optimization of electric motors usage in HEV system
 - ✓ Application of ECMS for Control strategy of new ELDOR_IHT HEV system

Date,

Signature of Tutor

Signature of the Phd student

The Coordinator