

MECHANICAL ENGINEERING

MUR DM 118 - Electrification of Urban Multi-tools Vehicles for public green areas

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Dipartimento DIMEAS
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Context of the research activity	<p>Study optimization and development and testing of a multi-tool vehicle for the treatment of green areas and public spaces is proposed. Particular attention to electrification in the maintenance of public green areas and the care of parks with reduced noise emissions and reduced pollution and emissions.</p> <p>Progetto finanziato nell'ambito del PNRR - DM 118/2023 - CUP E14D23001800006</p>
	<p>This PhD project is included in the framework of research and development of innovative and efficient “Non-Road Mobile Machineries” (NRMMs). Electrification of NRMMs represents one of the most relevant strategic goals for the Italian PNNR call when it comes to pollutant emissions reduction. In the last decades, the need for more efficient and highly productive working vehicles has pushed the scientific community and the major industrial manufacturers in the NRMM field towards the investigation of new architectural and technological solutions. The adoption of electrified powertrains, both as hybrid or full electric solutions, is showing in the automotive field the great benefits related to vehicle efficiency and emissions reduction which these technical developments can determine. Moreover, when it comes to NRMM, the adoption of electrical drives can bring to an increase in the overall productivity of a machine thanks to the high level of controllability, thus precision, of such technologies with respect to traditional solutions. In this scenario, the proposed PhD project aims to investigate new electro-mechanical design methodologies to be applied in this field, with a particular attention to mechanical strength and safety when it come to operating in very harsh and vibrational intensive conditions.</p> <p>the research activity is developed in collaboration between DIMEAS and the research group for hybrid electric vehicles for work and agriculture and some companies and organizations that can allow the experimental implementation of the project. In the academic and laboratory fields it will be possible to simulate the operational scenarios using appropriate software.</p>

Objectives

Furthermore, it will always be possible in the academic field to test the transmissions and previously simulated mechatronic solutions in the laboratory with small-scale systems. The possibility of developing a collaborative project with entities capable of inserting innovative electric vehicles under development will allow the PhD student to carry out a period of field testing. This type of experimental activity will allow the research to study the different models and evaluate the achievement of KPI objectives for the reduction of noise emissions and pollutant emissions in urban areas.

Project Goals

- Mechanical design and simulation of electric powertrains for off-road urban vehicles with the help of multi-physics numerical tools to develop dedicated control strategies able to optimize performance with different wheel-soil scenarios
- Design and development of modular test benches for performance evaluation of innovative powertrain for off-road and agricultural vehicles. Test benches should investigate Real-Time performance of the proposed control strategies using the most recent Hardware and Software-In-the-Loop (HIL and SIL) methodologies.
- Design and development of dedicated data acquisition platforms for field tests on real vehicles. Definition of dedicated field test protocols for performance verification.
- Simulation of dynamic performance of electrified vehicles in comparison with their conventional counterparts. Evaluation of KPI - vibration - acoustic emission - pollution
- Design and development of monitoring platforms for remote data acquisition in the framework of Industry 4.0

Skills and competencies for the development of the activity

Machine design
Mechanical simulation
Finite element simulation