Intervento realizzato da

In consideration of the determination of the Regione Piemonte – Direzione Istruzione, formazione e lavoro No. 218 of 2022, May 3 and s.m.i. which listed the higher institutions authorized to activate PhD positions in the apprenticeship format for the years 2022-2024 in the framework of a specific regional call for proposals (Apprendistato di Alta Formazione e Ricerca - Avviso Pubblico 2022-2026 per l'individuazione e la gestione dell'offerta formativa pubblica approvato con Determinazione 114 del 3/3/2022, modificato con D.D. n. 451 del 17/08/2022 e prorogato con D.D. n. 807 del 24/12/2024)

MECHANICAL ENGINEERING

Electrification of Agricultural Tractor Vehicles

Company	ECOTHEA SRL [P.iva/CF:11928890018]
Supervisor	SOMA' AURELIO - aurelio.soma@polito.it
Contact	Pablo Griotti
Context of the research activity	The collaboration is part of a research program in collaboration with the company Ecothea which will carry out its activity within the development of a research program in the field of electrification of vehicles and tractors for agricultural applications and for harvesting with particular reference to aspects of automation and autonomous driving. The company Ecothea has planned for the winner of this position a collaboration within a contract of high apprenticeship according to the Italian Legislative Decree 81/2015, art. 45.
	The growing interest towards the improvement in terms of performance and efficiency in working vehicles is pushing the academic research community and the manufacturers of these machines towards new challenges in the field of mechanical engineering. Nowadays, the use of optmized hybrid and electric powertrains is demonstrating its effectiveness in satisfying these needs, but is still open the discussion which set against each other solutions fully electrified and hybrid ones where the joint cooperation of thermal engines and electric solutions can improve the overall characteristics of the machine. Recently, also in the frame of paradigma 5.0, in the field of working vehicles autonomoud methods of autonomous drving is a new and demanding task. Especially in the field of agriculture, construction and handling are characterized by very hostile working conditions, requiring specific design and optimization strategies to protect the most critical subsystems. The

Objectives	adoption of electro-mechanical components and new driving algoritm in these harsh environment requires a specific knowledge in estimating the effects on their functionalities. The development of electric powertrains opens also these type of machines towards the application of innovative technologies for automatic guidance and task accomplishment in unstructured environments which still represents an open discussion due to the variability of the terrain conditions. The main objectives of the research can be anticipated schematically as follows: - Mechanical design and simulation of working vehicles. - Mechanical design of powertrains and subsystems for electric-hybrid applications in working vehicles. - Design and development of test benches for electric powertrains performance evaluation. - Development of test procedure to simulate mechanical loads from field experimental data. - Field tests and measurements in the frame of paradigma 5.0. - Design and simulation of vehicle dynamic behaviour in unstructured environments with deformable ground. Evaluation of the benefits of electric systems in improving vehicle performance in case of deformable ground. - Design and simulation of mechanical performance of battery pack solutions to be used in working vehicles solutions. - Development of data acquisition systems for field tests.

Skills and competencies for the development of the activity	The candidate shall be less than 30 years old at the moment of the hiring from the company. The skills of the candidate imply competences in: - Knowledge of a 3D CAD software for the design of mechanical components. - Knowledge of a Finite Element Method code for the analysis of structural components of electric powertrains to be used in working vehicles. - Knowledge of a Multi-Body code to simulate the dynamic behaviour of heavy duty vehicles in unstructured terrain conditions. - Knowledge in battery pack design is preferred. - Knowledge in mechanical design of electric powertrain for working vehicles is preferred.