MECHANICAL ENGINEERING

MUR DM 117/NEVC - Hybrid propulsion systems for high efficiency passenger and heavy duty vehicles

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]00518460019]- Beijing National New Energy Vehicle Technology Innovation Center Ltd [VAT no 91110302MA0191990R]
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Context of the research activity	Governments and institutions are globally encouraging the development and marketing of solutions with less impact on the environment through the definition of increasingly stringent regulations. One of the sectors with an undeniable impact on greenhouse gas (GHG) production is the automotive industry, where Internal Combustion Engine (ICE) based vehicles are responsible for 25-30% of global CO2 emissions. Manufacturers have a few ways forward to achieve these goals, one of which is the implementation of hybrid electric propulsion systems in their vehicles, where an ICE is coupled with one or more electric machines (EMs). The ability to optimize construction layouts with increasingly efficient solutions and the development of on-board energy flow management algorithms both in the traction and recovery phases make it possible to maximize the exploitation of the potential of this solution. Progetto finanziato nell'ambito del PNRR - DM 117/2023 - CUP E14D23001660006
Objectives	The objective of this research activity is to work on powertrain architecture optimization and design of control strategies to achieve the following objectives: a) Develop innovative formulations of energy flow management logics to maximize vehicle efficiency and reduce the amount of polluting emissions of passenger and heavy duty vehicles. The expected improvement will be depending on the specific vehicle architecture. b) Develop powertrains including supercapacitors into the powertrain to optimize the use of the battery storage system to lengthen its useful life. The expected improvement is between 10% and 20% in terms of expected battery life. c) Develop automatic design routines to allow the correct sizing of the entire hybrid propulsion subsystem; d) Introducing the perception of the road environment through ADAS sensors

	(camera, radar, lidar) into the energy flow management mechanism to obtain an improvement of between 10% and 15% in efficiency on passenger and heavy-duty vehicles. e) Study of powertrain based on fuel cells and design of the energy flow control for heavy duty vehicles The study will be conducted on passenger vehicles and light commercial vehicles.

Skills and competencies for the development of the activity	Matlab/Simulink based modeling and simulation. Mechanical and vehicle dynamics.