

ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

MUR DM 117/Stellantis - Next Generation GaN based power electronics for future BEV/FCEV

Funded By	CENTRO RICERCHE FIAT [P.iva/CF:07084560015] MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]
Supervisor	BOJOI IUSTIN RADU - radu.bojoi@polito.it
Contact	Vittorio Ravello
Context of the research activity	<p>Power Electronics is a key enabling technology for modern and more efficient power conversion in strategic fields of application, such as transportation electrification and eMobility. The PhD deals with study, design and development of GaN -based traction inverter for next generation of electrical vehicles using batteries and/or fuel cells.</p> <p>The research work will be carried out in a multidisciplinary environment inside the Power Electronics Innovation Center of Politecnico di Torino under the framework of a research project with Stellantis Spa.</p> <p>Progetto finanziato nell'ambito del PNRR – DM 117/2023 - CUP E14D23002000004</p>
Objectives	<p>In the last years, the Gallium-Nitride (GaN) technology has been evolving rapidly in terms of conduction and switching performance, allowing obtaining an outstanding efficiency and power density. In addition, since the most GaN devices are grown on standard silicon wafers, their cost is already highly competitive and expected to be lower with respect to the SiC technology.</p> <p>The main goal of the thesis is therefore the analysis, design and development of GaN-based traction inverter. The expected outcome is an inverter traction prototype with high efficiency (99%), high power density (> 100 kW/Liter), low EMI effects and minimum aging of the electrical motor. The thesis objectives include also the application of the GaN technology for on-board chargers.</p> <p>The PhD activity is divided into the following phases:</p> <ol style="list-style-type: none">(1) Study of the state-of-the-art of GaN technology and power devices for automotive applications(2) Study of topology analysis of GaN based automotive inverter

(3) Design, prototyping and initial functional testing of traction inverter
(4) Testing of traction inverter with eMotor and benchmarking with SiC solutions

Skills and competencies for the development of the activity

The research activity needs the following skills:

- Excellent background in static power conversion, including power electronic devices, converter topologies and control techniques.
- Hardware skills in design and testing of analog and power circuits.
- Very good knowledge of simulation software for power electronics, such as PLECS and CAD for power electronics design, such as Altium Designer.
- Teamwork mindset and ability to work in multi-disciplinary environment.
- Good logical and analysis capability, including good self-organizational mindset.