

## **Abstract**

At the present time, the climate changes represent the most relevant issues that compromise the planet and human future. As the acknowledgement and the interest of the public opinion are raised, the governments have started to promote clean energy production and sustainability to reduce the human activity pollutions. One of the most significant and participated example of this effort is the Paris Agreement. The electrification of the automotive sector represents an important step in this energy transition to reduce the greenhouse gasses produced by the fossil fuel combustion for the transportation sector. As a consequence, the electric vehicles are subject to a great pressure to improve the overall performances to fulfill the gap with traditional cars. In this context, the thesis focuses on the development and the optimization of an innovative automotive traction inverter. In order to achieve the stringent efficiency and power density requirements, the future inverter must adopt non-standard architectures and new technologies. In particular, GaN devices, PLZT ceramic capacitors and multilevel structure are selected as innovative elements. Firstly, they are compared with the respective state-of-the-art counterparts in order to outline the effective advantages. Then, they are combined in a single inverter prototype that exploits the complementary benefits. The presented research activity illustrate lots of contributions that focus on the semiconductor and capacitors technologies comparison, on the converter structure analysis and modelling and on the inverter design and prototype experimental validation.