.Summary

In order to limit the production of pollutant gases, the transportation sector, both public and private, has turned its attention to Electric Vehicles (EVs). The most important barrier to commercializing and spreading EVs are the issues regarding the battery. The batteries are heavy, bulky, expensive, and have a limited lifetime. Furthermore, frequent charging and limited operating range due to the low energy density are other obstacles to developing EVs worldwide. Dynamic Wireless Power Transfer (WPT) is a possible solution in order to solve the problems related to the battery. In this solution, the battery of the EV can be charged when the vehicle is in motion. In this kind of charging system, the transmitter coils are embedded into the ground and the receiver coil is installed underneath the vehicle. Through a sufficient charging infrastructure large enough to charge the electric vehicle during driving, the size of the battery onboard can be reduced and the driving range of the EV can be extended.

The main goal of this thesis is research on the development and control of a 100-m segmented charging system for dynamic charging of an electric vehicle. The rating power of the charging system is 20 kW at the nominal air-gap of 25 cm. Due to its simple structure and good performance in dynamic charging conditions, series-series compensation topology has been chosen for the compensation of the self-inductances of the coils at a frequency of 85 kHz. One of the major difficulties involved in dynamic WPT systems is the control of the amount of power received by the battery as the vehicles travel along the road with fast speed. One possible solution is the establishment of a communication link between the EV and the ground. However, communication links may cause delays and affect the charging process. Here, two new control strategies for regulating the output power with different power electronics are introduced. These control methods are able to regulate the battery power from the EV and without any establishment of the communication between vehicle and ground, even in the case of lateral misalignment or variations of the air-gap. Subsequently, the complete simulation of the system in static and dynamic charging conditions is performed and the operation in different charging conditions such as variations of the operating frequency, power demand, lateral misalignment, vehicle speed, and air-gap, is studied. The procedure for the construction of the charging lane with the development of the coils, the embedding procedure and implementation of the power electronic converter is presented. The results obtained by the experimental tests show good coherence with the simulation results.