

## **Abstract**

This work presents a drive inverter that focuses on a high-performance DC-DC converter with a cascaded PI controller. The converter offers improved performance and efficiency through the implementation of a two-stage proportional-integral control system. The theoretical foundations, construction details, and practical test results with a fixed duty cycle are presented and analyzed in detail.

The first step involves the setup and testing of the system using MATLAB Simulink and Simscape Electric. In the second step, the model was realized in the laboratory and tested with a fixed duty cycle. The results of this experimental validation are discussed and demonstrate the efficiency and performance of the developed synchronous DC-DC converter.

The entire system consists of the DC-DC converter, which is the focus of this work, as well as a DC-AC inverter with an MSK switching sequence that is connected to a permanent magnet synchronous machine (PMSM).

The behavior of the buck-boost converter is examined in both dynamic and steady-state conditions, with the mathematical equations of the state-space model of the system being derived.