universität innsbruck

innsbruck Drive and Energy Systems Laboratory

Bachelor Thesis @InstitutFürMechatronik

Resonant Circuit Design for Next Generation Power Converter

Background: Resonant circuits are widely used in modern power electronics to improve efficiency, reduce switching losses, and enable high-frequency operation. By shaping the voltage and current waveforms through resonance, such circuits allow soft-switching conditions and contribute to more compact and reliable converter designs. In this project, the student will first study general design methods of resonant circuits and derive their fundamental characteristics through theoretical analysis. Building on this foundation, the derived methods will be applied to the design of a resonant circuit intended for a novel power converter topology. The specific converter details remain confidential, but the work will emphasize transferable skills in resonant circuit design and analysis.

Objectives: Gain a comprehensive understanding of resonant circuit principles and general design methodologies. Perform theoretical analysis to derive the electrical characteristics of resonant circuits. Apply the design and analysis results to a new type of power converter.

Approach: The project commences with a literature review and theoretical study of resonant circuit topologies, including series, parallel, and LLC structures. Analytical methods will be used to extract characteristic parameters, including resonant frequency, impedance behavior, and soft-switching conditions. Simulation tools will then be employed to validate the derived characteristics. Finally, the designed resonant circuit will be adapted and applied to a next-generation power converter, and its performance will be evaluated.

Tools/Software: Matlab, PLECS, and C

Prerequisites: knowledge of circuit theory and power electronics is helpful, but no specific prerequisites are required.

Application and Supervision:

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