

PLECS

DEMO MODEL

Resonant Half-Bridge SLR Converter

Last updated in PLECS 4.3.1

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1 Overview

This example shows a half bridge series-loaded resonant (SLR) DC/DC converter.

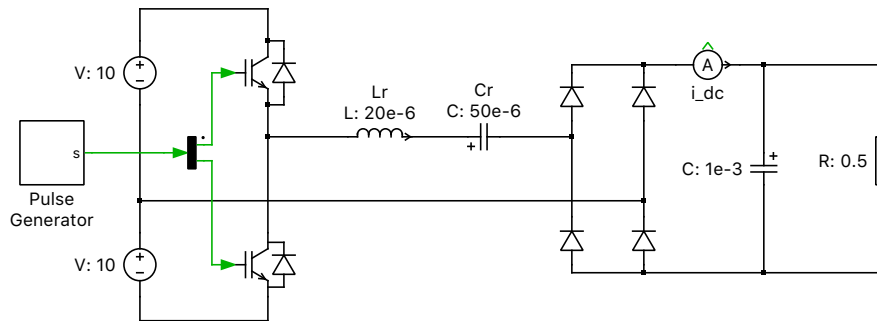


Figure 1: Schematic of the half bridge series-loaded resonant (SLR) DC/DC converter

2 Model

Resonant converters have a resonant tank network consisting of inductors and capacitors between the switch stage and the rectifier. The switch stage can be a half bridge or full bridge arrangement, comprised of two or four switches, respectively. The resonant tank can consist of a series or parallel configuration of just one inductor and one capacitor. Alternatively, a resonant converter can comprise three passive storage elements, with at least one capacitor and one inductor. With these types, a capacitor and an inductor are connected in series, and are then both in parallel with either a single capacitor or inductor. Such converters using three components for the resonant tank are designated as either an LCC or LLC converter.

Resonant converters can be described as having multiple subintervals during which the conduction states of all switches are constant. If during any subinterval the current in the tank inductor is zero due to all four rectifier diodes being reverse-biased, then the converter is operating in discontinuous conduction mode (DCM). The converter operates in continuous conduction mode (CCM) if the current in the resonant inductor never remains at zero.

This model is of a series resonant tank type, with a single inductor and single capacitor connected in series. The resonant tank frequency of the inductor and capacitor is 5033 kHz. The converter uses a half-bridge switch network and a capacitor to filter out the high frequency harmonics at the load. The switching frequency can be toggled to operate the converter in both CCM and DCM.

A demonstration of a full bridge series-loaded resonant converter is given in the demo model “Resonant Full-Bridge SLR Converter” in the PLECS demo models library.

3 Simulation

Run the simulation with the model as provided to view the signals and verify that the converter operates in DCM for a portion of the cycle. Switch the configuration of the Pulse Generator subsystem block to “Continuous”, which will increase the switching frequency. This in turn forces the converter into CCM operation, and increases the output voltage. The results for both simulations of the resonant inductor current i_{L_r} are given in Fig. 2.

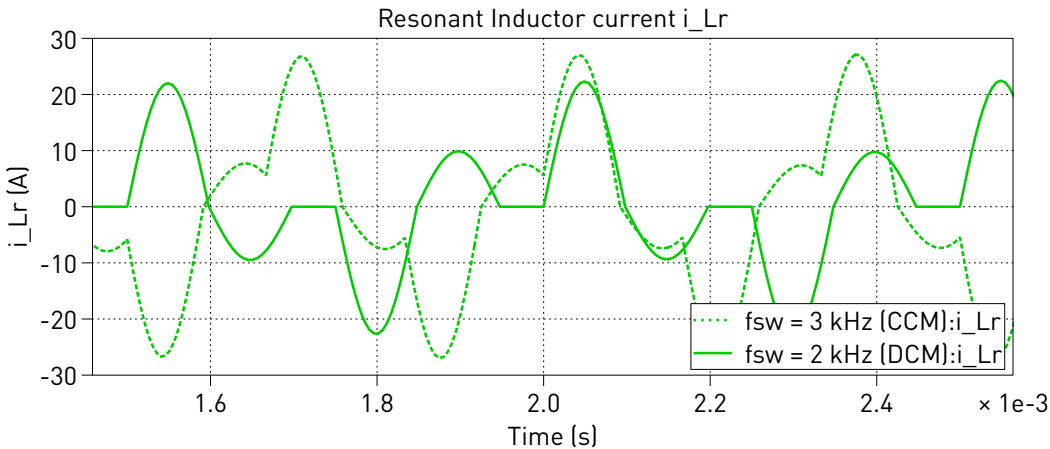


Figure 2: Results of the resonant inductor current simulation for different switching frequencies (2 and 3 kHz)

Revision History:

PLECS 4.3.1 First release

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PLECS Demo Model

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