



PLECS

DEMO MODEL

Thyristor Chopper Circuit

Last updated in PLECS 4.3.1

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1 Overview

This demonstration shows how a single thyristor is used to chop an AC voltage applied to an RL load.

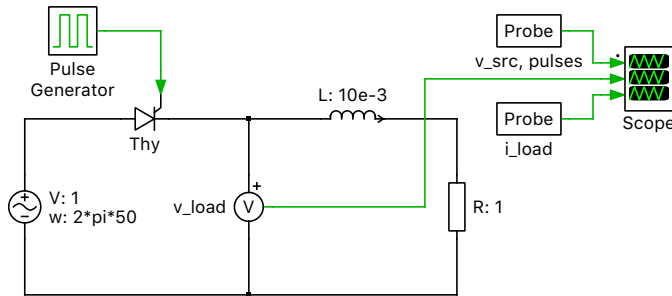


Figure 1: Thyristor chopper circuit.

2 Model

A thyristor (also known as a silicon-controlled rectifier or SCR) is a three-terminal device that behaves like a diode, as it is capable of conducting current in only one direction. However, unlike a diode, it is not biased on with a positive voltage across it, but rather triggered by an external gate signal. The switch then naturally opens when the current through the device passes through zero. In contrast to fully-controllable switches, the turn-off is a natural commutation, rather than a second gate signal.

Due to its control properties, the thyristor can be used to “chop” an alternating current to an inductor. The inductor inherently resists an instantaneous change in current, and therefore the thyristor in this circuit cannot be replaced by hard-switched devices such as MOSFETs or IGBTs. This is because these switches turn off based on a control signal that disconnects the load from the mains, therefore removing any path for the inductive current to flow.

3 Simulation

Run the simulation with the model as provided to view the signals and verify that the load voltage is a chopped version of the source voltage waveform. Simulation result is provided in Fig. 2. Also see that the load voltage becomes zero once the load current passes through zero, the point at which the thyristor turns off. Then replace the thyristor with a MOSFET to see that the simulation aborts when the current in the inductor is forced to jump to zero, which would destroy the MOSFET in reality.

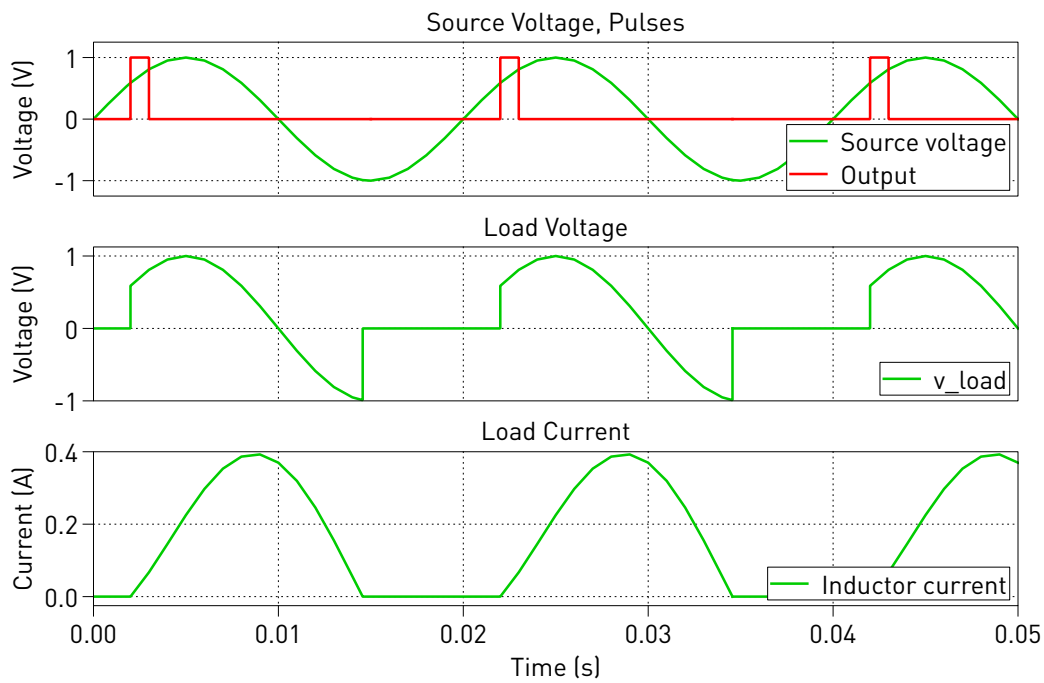


Figure 2: Simulation result of thyristor chopper circuit.

Revision History:

PLECS 4.3.1 First release

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