PLECS

DEMO MODEL

Forward Converter
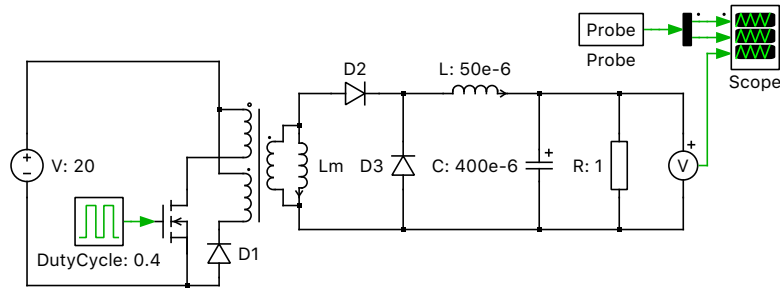
Last updated in PLECS 4.3.1

1 Overview

This example demonstrates a single-transistor unregulated forward converter.

Figure 1: Forward converter

2 Electrical model

A forward converter is a DC/DC converter with an output voltage higher or lower than the input voltage. A transformer provides isolation between the input and output sides and directly passes energy from the primary side winding to the secondary side winding while the switch is conducting.

The equation for the ideal transfer function of a forward converter is:

$$\frac{V_{\text{out}}}{V_{\text{in}}} = D \cdot \frac{N_{\text{s}}}{N_{\text{p}}}$$

where D is the duty cycle and N_{p} and N_{s} are the number of turns in the primary and secondary side windings, respectively.

This model includes a magnetizing inductance in parallel with the secondary side winding of the ideal transformer. A third demagnetizing winding is also connected to the primary side, providing a return path through the diode and allowing a de-magnetizing current to travel once the switch is turned off. It is common practice to have the same number of turns on the primary and demagnetizing windings so to have the transformer totally demagnetized before the switch starts conducting, avoiding transformer saturation.

In this example the transformer has a 2:1 winding turns ratio and a duty cycle of 0.4.

3 Simulation

Run the simulation with the model as provided to view the signals and verify that the load is

$$V_{\text{in}} \cdot D \cdot \frac{N_{\text{s}}}{N_{\text{p}}} = 20\,\text{V} \cdot 0.4 \cdot \frac{1}{2}$$

or approximately $4\,\text{V}$. Then adjust the windings turns ratio or duty cycle to increase or decrease the output voltage.

Revision History:

PLECS 4.3.1   First release

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