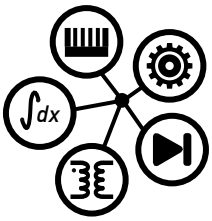

PLECS

DEMO MODEL

Flyback Converter with Analog Controls

Last updated in PLECS 4.4.2

1 Overview

This example demonstrates a three-output flyback converter with closed-loop control of one output.

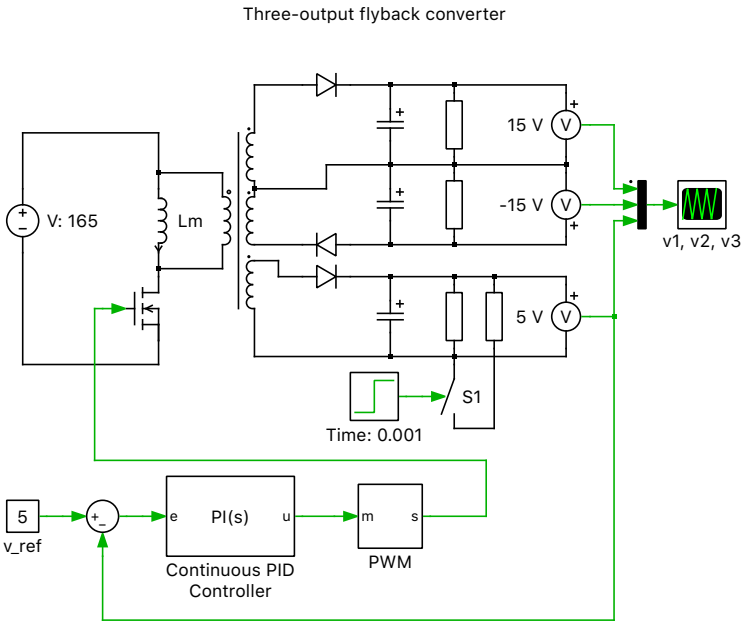

Figure 1: Schematic of the three-output flyback converter with closed-loop control

2 Model

2.1 Electrical system

A detailed description of the flyback converter is given in the demo model “Flyback Converter” in the PLECS demo models library.

This model represents an ideal DC/DC flyback converter with no parasitic elements, three separate output windings and regulation via a simple analog control scheme. The transformer is designed to have three separate windings on the secondary side and outputs three voltages: $-15\,\mathrm{V}$, $5\,\mathrm{V}$, and $15\,\mathrm{V}$. A load step change is made half way through the simulation on the $5\,\mathrm{V}$ output winding by switching in an additional load resistor.

2.2 Controls

Voltage regulation is performed on the $5\,\mathrm{V}$ output winding using an ideal shunt voltage sensor. A voltage set point of $5\,\mathrm{V}$ is compared to the measured output voltage on the $5\,\mathrm{V}$ output winding and this error difference is passed to a basic PI control scheme. The PI controller sums a proportion of the present error and a separately weighted component of the past error by integration to minimize the error difference between the two signals. The PI controller’s output then sets the modulation index of a pulse-width modulation (PWM) signal that gates the MOSFET.

3 Simulation

Run the simulation with the model as provided to view the signals and verify that the three load voltages are stable after the load step-change and that the controller regulates out the disturbance well.

Change the value of the resistance being switched in to see at what reduction in the load resistance the controller no longer is able to maintain the output voltage specifications of $-15\,\mathrm{V}$, $5\,\mathrm{V}$, and $15\,\mathrm{V}$ to within tolerances of $0.5\,\mathrm{V}$ on the low voltage winding and $1\,\mathrm{V}$ on the others. (Reduce the parallel load resistance on the $5\,\mathrm{V}$ output winding to 1/3 of the original value by changing the resistance being switched in to $0.625\,\Omega$ and observe that the sag in the average voltage for each winding after the load changes is at the limit of the target specifications.)

Revision History:

PLECS 4.3.1	First release
PLECS 4.4.2	Update PI controller component

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PLECS Demo Model