Inverter with C-Script-Based PWM Modulator

Last updated in PLECS 4.3.1
1 Overview

This demonstration shows an ideal MOSFET inverter that is controlled by a custom PWM scheme. The switching strategy creates a bipolar output voltage of \( V_{dc} \) or \(-V_{dc} \) and is implemented as a state machine using the C-Script block.

![Diagram of Inverter with C-Script-Based PWM Modulator](image)

Figure 1: Inverter with C-Script-Based PWM Modulator

2 Model

2.1 Power circuit

An idealized full-bridge single-phase MOSFET inverter is modulated to create a 400 VDC square wave from a 400 VDC source. The square wave is then conditioned to represent a sinusoidal waveform of approximately 230 VAC using an LCL filter.

2.2 Control

A dead time is added between switching transitions to ensure that short circuits across the DC bus do not occur. A minimum on-time requirement for each switch has also been included. Both of these parameters, along with the switching frequency, are masked parameters for the PWM subsystem. Since they are directly passed to the C-Script block as inputs, the values can be changed at the top level of the schematic for analyzing various effects.

![Timing diagram of a single switching cycle with blanking time](image)

Figure 2: Timing diagram of a single switching cycle with blanking time

The figure above shows the timing of a single switching cycle with blanking time \( t_4 = t_2 - t_1 = t_4 - t_3 \) between switching transitions. The state machine concept is not only useful for pattern generation but can easily be adapted to respond to external rather than internal events for applications such as control system sequencing.
3 Simulation

Increase the dead time ratio and monitor the load voltage to observe the dead time effects of distortion and attenuation on the output waveform. Fig. 3 depicts the output voltage for a blanking time of $1\mu$s. The PWM modulation signal with blanking time can be observed in Fig. 4.

![Filter Output Voltage](image)

**Figure 3: Filtered AC output voltage**

![PWM Modulation Signal](image)

**Figure 4: PWM modulation signal with blanking time**
Revision History:

PLECS 4.3.1 First release

How to Contact Plexim:

☎ +41 44 533 51 00 Phone
☎ +41 44 533 51 01 Fax
✉ Plexim GmbH Mail
Technoparkstrasse 1
8005 Zurich
Switzerland
✉ info@plexim.com Email
http://www.plexim.com Web

PLECS Demo Model
© 2002–2023 by Plexim GmbH

The software PLECS described in this document is furnished under a license agreement. The software may be used or copied only under the terms of the license agreement. No part of this manual may be photocopied or reproduced in any form without prior written consent from Plexim GmbH.

PLECS is a registered trademark of Plexim GmbH. MATLAB, Simulink and Simulink Coder are registered trademarks of The MathWorks, Inc. Other product or brand names are trademarks or registered trademarks of their respective holders.