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Abstract

Transient and Small Signal Analysis of PWM Converters
Using Average Switch Model

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The objective of this project is to improve the simulation technique of PWM converters. There are two major ways to simulate PWM switching circuits: Average switch models approach (ASM) and cycle-to-cycle transient models approach (CCM). In this paper, different types of PWM switching converter are presented and simulated in both CCM and ASM by using PSPICE simulation program. Simulation results are compared and we can verify a good agreement between two models.

Resonant switching converter is not a PWM switching converter. In order to discuss the topic of DC-DC converter in a wider scope, the resonant switching converter is included. Different types of zero-current-switch and zero-voltage-switch converters are analyzed by different method using PSPICE.

A Forward DC-DC converter is selected to enable the transient and small signal analysis using ASM. The audio susceptibility, controls to output characteristic and output impedance are presented.

A newly proposed Boost PWM soft-single-switched converter of ASM operating in continuous conduction mode is developed. This model is implemented by a PSPICE sub-circuit to enable small signal and transient analysis. Results of DC and transient analysis on this ASM model and on a straightforward CCM are compared to verify its validity. An excellent agreement is obtained. Small signal analysis results are also given. Using the ASM in performing the same simulation, the simulation time is at least 3 orders of magnitude less than that of the CCM. The susceptible to numerical convergence problem and memory used also reduce when using the ASM.