Comparative Analysis of PID Controller and Current mode Controller in Matlab Simulink for DC-DC Buck Converter

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Abstract

The DC-DC converters different varieties are widely used in markets such as automotive, telecommunication, medical and electronic appliances with prominence on stability of the output voltage. Input voltage and load variations are the main reasons which affect the proper operation of DC-DC converters. When the desired output doesnot follow the input, the controller is used to minimise the output error. Proportional-integral-derivative (PID) control is the most frequently employed type of control due to its simple execution, fast calculation along with higher efficiency. In this paper the PID controller and the current mode controller (CMC) are implemented in Matlab Simulink. A detailed performance analysis was carried out under both line and load regulation conditions. In addition, a comparative analysis for output response of controllers in tabular form is provided, on the basis of the number of feedbacks required, settling time, rise time and percentage overshoot at constant line voltage.

KEY WORDS: DC-DC converters, PID controller, CMC controller

1. Introduction

In the cutting edge world, the innovation is developing so quick that it has become an incredible test for the engineers to think of improved control method to enhance output response of DC-DC converters. DC-DC converters are utilized to balance out input DC voltage to required level. The DC-DC controller is an electronic circuit or algorithm which alters the duty cycle of the pulse width modulator (PWM) so that output is kept at required level .Deciding the perfect strategy for output voltage control in DC-DC converters is a requesting task because of their nonlinear character and methods of utilization. They are normally utilized in all electronic appliances which require efficiently controlled DC power supply. DC-DC converters are broadly utilized in electric autos, marine cranes, voltage controllers, mine haulers, batteries and so forth. The DC-DC converters have the issues of non-linearity due to saturation inductance, voltage clipping and so on. On account of this non-linearity, the effectiveness and stability of DC-DC converters degrades. Numerous kinds of Linear and non-linear regulators are being utilized for the control of DC-DC converters. Linear converters however are simple and easy to execute, but they are bulky and inefficient. So as to defeat these drawbacks, the non- linear regulators come into existence. The main component in the non-linear DC-DC converter of switch mode power supply (SMPS) is a switch such as MOSFET, IGBT, and diode having efficiency greater than 90% [1-2-3]. This literature consists of four sections, in the first section open loop buck converter under constant input and line disturbances is investigated in Matlab Simulink and output response is given in the form of results obtained. The second part of this literature discusses output response of buck converter with PID controller under constant input voltage, the varying load and input voltage. The third section investigates the output response of buck converter with CMC controller with constant, varying line voltage and load. Finally output response of the open loop buck converter, PID controller and CMC controller are compared on the basis of number of feedbacks required ,settling time, rise time and % overshoot.