A Simple Feed-Forward Controller Design
for DC-DC Buck Converter

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Single-Inductor-Dual-Output (SIDO) switching power supplie use one inductor to serve for two converters. It is an avariable method to reduce power loss, converter volume and save cost. However, only one inductor must serve for two converters, the interaction between sub-converters is the problem. Cross-regulation is the most common one. This paper
   --proposed a simple method to design feed-forward control for buck converter.
   --the feed-forward controller is used to improve the transient response of DC-DC buck converters
   --by improved transient response, cross-regu2ltion also be improved.
   The proposed feed-forward control is based on charge balance of output capacitor. The result of integrating the current of the output capacitor is used to regulate the saw-tooth signal, which in turn is used to compare with the error signal to get the PWM drive signal. The advantage of the proposed controller is reducing the control delay to improve transient response, and does not require complicated and accurate calculation of the digital controller, whether for single inductor single output (SISO) converter or SIDO converter.
   Fig.1 shows the proposed control scheme of SISO DC-DC buck converter, which includes a normal output voltage feed-back controller and the proposed feed-forward controller. The current of the output capacitor is detected and integrated. This result is used to control the saw-tooth generator. Because of this, before the error between output voltage and reference voltage is changed, the modulation of the saw-tooth signal takes the lead in changing the duty cycle of the PWM signal. Compared with a feed-back controller, feed-forward control can regulate the system faster when there is a load-change disturbance. By integrating the output capacitor current, it is possible to roughly determine how much the saw-tooth must be changed based on the charge balance.
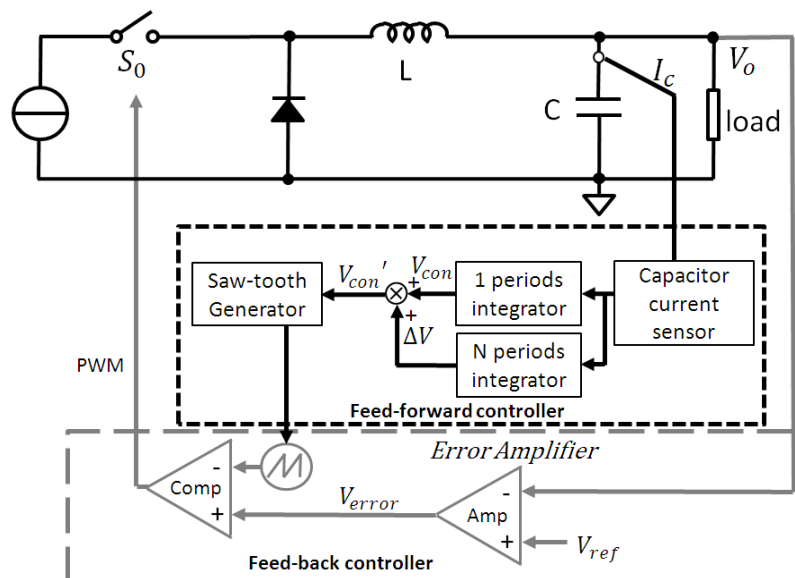

Fig. 1 Buck converter with proposed controller.