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Design for Boost DC-DC Converter Controller Based on State-space Average Method Keywords: State-space Average Method, Boost DC-DC Converter, PI controller Abstract. In the process of designing high performance switch power, need to establish the accurate mathematical model of converter. The DC/DC converter generally has the characteristics of nonlinear, multimodal, time-varying, so need to use new methods to study it. The work of this paper aimed at non isolated DC / DC converter, established

11**the mathematical model of Boost converter**

circuit

2**by using the state space** average **method.** Then design **the**

closed-loop PI controller based on the Boost converter model, the closed-loop system has good static and dynamic performance, to meet the requirements of use. 1 Introduction In recent years, the bidirectional DC / DC converter has become a hot topic. It can

4**reduce the volume** of weight **and cost of the** system in **the**

bidirectional flow of energy for applications .The bidirectional DC / DC converter has been widely used in UPS systems, space power systems, electric vehicle drive and battery charge and other occasions. The directional DC / DC converter achieves a two-way to transmission of energy, it's functionally equivalent to two DC-DC converter. With the development of science and technology, the DC-DC converter is required to higher efficiency, a wider range of input and output voltage, smaller electromagnetic interference. There- fore the design requires the more accurate mathematical model to accurate control the output .the bidirectional DC / DC converters are divided into two categories: one is a digital simulation method and the other is analytical modeling method [1]. State-space averaging method is one of analytic modeling method, which is

the most basic method and widely applications. This model is simple, physical concept clearly, we can use linear circuit theory to analysis the steady-state and dynamic-state [2]. This paper will be based on

3the state space average method to design the controller of

DC/DC converter. 2 Introduction to

2state-space averaging method State-space averaging method is based on

linear RLC elements, independent power and the network consisting of switch. the voltage of capacitor and the current of inductor as state variable, according to the power switching's "ON" and "OFF" two states, to obtain an average variables over a period of state turning a nonlinear,

6time-varying, switching circuit into an equivalent linear, time-invariant, continuous circuit,

which can determine the small-signal transfer function, the establishment of state-space average model [3]. 2.1 The conditions of state-space averaging method Modeling One

10advantage of the state-space averaging method is

that it can be used the model of classical linear control and theory of linear circuits to analysis the DC-DC converters for steady-state and small-signal. The system must meet the following three conditions: AC small-signal frequency should be much less than the switching frequency ; converter

9frequency is far less than the switching frequency ; the amplitude of

each AC circuit must be much smaller than the DC compo -nent. In the DC-DC converter, the higher switching frequency, it is easier to meet the conditions of low-frequency, small ripple and small signal. Ignore the switching frequency, sidebands, as introdu -cing switching cycle average operator, is shown. Among them, is a converter variable, as switching cycle. 2.2 The state space averaging method modeling process (1) Stages of writing state equations and calculate the average amount When , D as the duty ratio of the switch, the switch Q is switched on, and then the work mode corresponding of circuit topology has the following state equation: When , the switch Q is turned off, similar to equation of state is shown as follows: After averaging can be below the average state space equations: (2) for the static working point and separate the disturbance Let derivative is zero, the static working point is shown as follows: Among them, Type (6) for the static type solution: The static solution, disturbance by small, the small signal model, the disturbance are as follows: Smaller perturbation， That is： ， Into the state equation, eliminating DC component, the follows are available: (3) Linearization Ignoring two order alternating small of the type (8), then get the AC small signal model of DC converter. 3 Boost converter modeling

8based on state space average method The topology of Boost converter[

4] (1) according to the electrical characteristics of each element and modeling step described in section 2.2

3， the matrix form of state space average equation can be

available. (2) Separation of perturbation and linearization Introducing small signal perturbation, eliminating the steady-state component and the two term component, then the AC small signal state equation is: (3) Solve transfer function of the system According to the state equation, Boost converter from input to output transfer function can be respectively obtained[5]： from control to output transfer function： 4 controller design based on the transfer function 4.1 The design of Boost converter controller Block diagram of control system of DC-DC converter is shown in figure 2. Literature [5] conducts modeling and simulation for the Boost converter in open-loop state. The results show that the output characteristics is not very ideal, it needs to be corrected, in order to obtain good dynamic effect. In the picture above, as the correction link, is the key to design the whole control system; for modulation transfer function PWM links, is the proportion link; as the feedback part, is also generally proportional. In the design of a control system, need to have good dynamic performance, "tracking given, rejecting disturbance" on the whole [6]. In the suppression of distu -rbance, there are disturbances from the input power and output load. The control system of a transfer function is as follows: The above analysis, assuming that, in the actual system when it is not 1, only need to change the response ratio .correspondingly, the actual circuit parameters are that,. 4.2 controller simulation based on Matlab/SimPower From the figure 3, the PI controller output voltage of the system rises to the set value in 0.015s ,overshoot is about 1%, and finally stabilized at around of set value, the system has a good static and dynamic performance .The following will analyze the performance of immunity. System disturbances are mainly including the voltage disturbances and load disturbances. We will analysis the output of the system with disturbance. In the simulation model, when t = 0.02s disturbance happens, the power voltage increased from 10V to 11V,in the change of 10%, the output response shown in Figure 4(a).The figure shows The output voltage, the voltage increases to 21V, after 0.02s returned the setting value, it indicated that the closed loop control system with the abil -ity to reduce the voltage disturbances and the set-point can be tracked .the overshoot is about 5%, adjustment time is 0.02s, the system has good ability to against voltage disturbances .When the load changes, the load resistance from 5Ω to 6Ω, change of 20%. The simulation results shown in Figure 4(b). From the simulation result, we can see the output voltage fluctuations, voltage increases approximately 1V, after 0.02s the output voltage returns to a stable state. The closed-loop control system can reduced the load disturbances .Based on the above analysis; PI closed-loop controller can improve system performance. 5 Conclusions This paper not only analyzes the advantages of state-space averaging method, but also need to pay attention the conditions, then gives steps and methods of building a mathematical model of the system .the mathematical model of Boost converter to solve practical problems with the

4state-space averaging method. The purpose of establishing a mathematical model of

the system is to be well controlled, to get a better output. Therefore, based on the model of transfer function of the converter, based on the transfer function to design the closed loop controller, PI controller is easy to implement, finally the system has good static and dynamic performance, and good immunity performance.

Reference [1] Lei Xiaojuan,Chai GUILAN.Stability analysis of BOOST converter based on the state space average model[J].Science & Technology Information,,2009(3):257-258. [2]

1**J. Mark Noworolski Xiaojun Z. Liu and George C. Verghese** SETH R. SANDERS **.Generalized Averaging Method for Power Conversion Circuits[** C **]//IEEE** TRANSACTIONS ON **POWER**

ELECTRONICS,1991:251-259. [3] Song Shoujun,Liu Jinglin,Zhang Zhihui.Modeling of the BUCK Converter and Simulation of Its Advanced Control Methods[J].Computer Simulation,,2006(3):294- 300. [4] Dong Fengbin Huang JINFENG.Research for Unified Modeling of DC-DC Converter Based on Average State Space Method[J].Electrical Engineering,,2008(7):21-23. [5] SU Hong-sheng ZHANG Yun-chuan WANG WEN-BIN.Modeling and simulation analysis of boost DC-DC converter based On state-space average method[J].Electrical Drive Automation,2013(9):38-41. [6]

7**Lin Botao Qiu Shuisheng.** Limit Cicles in **PWM Switching Power Converters**

and State Space Averaging

5**[J].Journal of South China University of Technology (Natural Science),1997,25(**

3):58-62.