Lica, Septimiu; Lascu, Dan; Lovasz, Evelyn-Astrid

A new step-up-down quadratic dc-dc converter with a single active switch. (English)

Zbl 07738630

Summary: A novel step-up-down quadratic dc-dc topology is proposed. After performing the dc analysis, it is found that the proposed converter has a wide dc conversion ratio. The current and voltage stresses and ripples are determined alongside the continuous conduction mode (CCM) operation conditions. The correct converter operation is verified by simulation and then through the measurements on an experimental prototype. Additionally, a design algorithm is proposed together with an example of applying it for building a practical prototype. The design algorithm is implemented in a numeric computing platform. The state-space model is derived for both for the ideal case as well as considering the conduction losses. The control to output transfer function and the audiosusceptibility are computed. It is shown how the fourth order control to output transfer function can be well approximated by a second order transfer function. This approximation brings the advantage of simple controller design based on classical techniques. Both classical operational amplifier (Op. Amp.) based controllers and widely available controllers in the form of integrated circuits (ICs) can be used for the implementation, requiring only the calculation of elements in the feedback loop of the error amplifier. Based on the transfer functions of the converter and of the Laplace domain controller, a digital controller may also be derived. An example is presented and simulated to prove the correct operation of the closed-loop system.

MSC:
93-XX Systems theory; control
78-XX Optics, electromagnetic theory

Keywords:
dc-dc converters; static conversion ratio; inductor current and capacitor voltage ripples; small-signal transfer function; controller design; closed loop system

Full Text: DOI

References:


[3] Lascu, D., Controlled Energy Transfer using PWM and Resonant Converter (1998), Polytechnic University of Timisoara: Polytechnic University of Timişoara Romania, (Ph.D. thesis)


This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.