

PROJECT TITLE

Performance Analysis of a High Gain Non Isolated Hybrid Zeta Converter in Buck and Boost Modes Using eSim

PROBLEM STATEMENT

The reference paper proposes a non isolated hybrid Zeta converter that provides a higher positive voltage gain at a smaller duty cycle than conventional buck boost converters while maintaining continuous input current. Its performance was evaluated in MATLAB Simulink and on an OPAL RT hardware in the loop platform. This research migration will reconstruct the published power stage in eSim and use ngspice transient analysis to reproduce its boost and buck operating behaviour. The eSim waveforms will be compared with the theoretical, simulation, and hardware results reported in the paper.

TOPOLOGY

The converter uses two independently controlled unidirectional power switches, two diodes, two inductors, an energy transfer capacitor, an output capacitor, and a resistive load. The first switching path charges the input inductor and transfers energy through the Zeta capacitor. The second switching path provides an additional source to output energy path. The diodes establish three operating intervals, while the output inductor and capacitor smooth the load voltage. The published test case uses a 36 volt input and a 10 kilohertz switching frequency.

OBJECTIVES

The objectives are to build the complete converter in eSim with meaningful component and node labels, implement the two published gate intervals, reproduce the 36 volt to 72 volt step up case and the reported step down case, plot output voltage, inductor currents, capacitor voltage, and switching waveforms, verify continuous conduction and steady state voltage gain, quantify ripple and deviation from the published MATLAB Simulink and hardware results, and document the models, parameters, analyses, and outputs required by the FOSSEE submission guidelines.

EXPECTED RESULT

For the step up case, the theoretical and MATLAB Simulink output is approximately 72 volts for a 36 volt input, while the paper reports approximately 70 volts in hardware in the loop testing. The eSim result is expected to settle within the 70 to 72 volt range, with continuous inductor currents and a load current close to 2.3 amperes for a 30 ohm load. Reproducing the step down response will confirm operation in both conversion modes.

REFERENCE

Padala Lakshmi Santosh Kumar Reddy, Yeddula Pedda Obulesu, Srinivas Singirikonda, Mosleh Al Harthi, Mohammed S. Alzaidi, and Sherif S. M. Ghoneim, A Non-Isolated Hybrid Zeta Converter with a High Voltage Gain and Reduced Size of Components, Electronics, volume 11, issue 3, article 483, 2022, 17 pages. DOI 10.3390/electronics11030483.

SOURCE OF THE PROJECT

Electronics, an international peer reviewed open access journal published by MDPI AG, volume 11, issue 3, article 483, 2022, eISSN 2079-9292.