



A MODIFIED SEPIC CONVERTER USING HIGH STATIC GAIN FOR SOLAR APPLICATIONS

¹Ameer Hasim Bunyan ²Ch. Punya Sekhar (M.Tech, PhD)

¹M.Tech student Department of Electrical and Electronics Engineering, Acharya Nagarjuna University, Guntur, Andhra Pradesh, INDIA

²Assistant Professor, Department of Electrical and Electronics Engineering, Acharya Nagarjuna University, Guntur, Andhra Pradesh, INDIA

¹ameerjasim48@gmail.com, ²punya286@gmail.com

ABSTRACT: This cardboard presents a top addition DC-DC advocate based on the adapted Individual Ended Primary Inductance Advocate (SEPIC) for accomplishing top changeless gain. This advocate cartography is the aggregate of a classical addition advocate and a accepted SEPIC converter. The adapted SEPIC advocate acclimated for low ascribe voltage and top achievement voltage appliance to get adapted appropriate like Top changeless gain, Top ability with ZCS about-face on. The adapted SEPIC advocate can be analysed with two types of configurations namely with alluring coupling and after alluring coupling. The alluring coupling allows the access of the changeless accretion advancement a bargain about-face voltage. Two configurations operating with an ascribe voltage according to 15V and an achievement ability according to 100W. The agreement after alluring coupling operating with an achievement voltage according to 150V and with alluring coupling operating with an achievement voltage according to

300V. For a qualitative analysis, simulations of both topologies were performed, and compared, aftereffect appearance SEPIC with alluring coupling accord adapted gain.

Keywords—SEPIC converter, Topology of SEPIC, Simulation Results

INTRODUCTION

One of the aloft apropos in the ability area is the circadian accretion ability appeal but the dearth of abundant assets to accommodated the ability appeal appliance the accepted activity sources. So, the development of top changeless accretion (G) dc–dc converters is an important architecture due to present’s appeal of low voltage renewable sources like solar PV, wind energy, ammunition corpuscle applications in carriageable cyberbanking equipment, uninterruptable ability supply, and array powered equipment. Classical non abandoned Addition advocate gives bound voltage accretion of about $G=5$ with assignment arrangement of 0.8 and



commonly can accomplish with an able changeless and activating performance. A dc–dc advocate operating with a changeless accretion ambit until $G = 5$ is advised a accepted changeless gain, a changeless accretion ambit college than $G = 10$ is advised a top changeless accretion band-aid and an operation with changeless accretion college than $G = 20$ is advised a actual top changeless gain. Many techniques are acclimated to get Top changeless accretion in classical DC-DC converter. Techniques activated on non-isolated advocate like Voltage multiplier cells, Switched Capacitor/Inductor technique, alluring coupling, interleaved address and aswell aggregate of these gives bifold allowances of Top changeless accretion with abreast added adapted characteristics. The abject cartography is actuality advised as a SEPIC DC-DC converter. But it generates bound accretion aforementioned as addition advocate aswell has top ascribe ripple current. So to access the accretion aloft techniques is acclimated and from that two topologies are acquired that are advocate after alluring coupling and with alluring coupling. Table appearance adapted SEPIC advocate topologies uses beneath amount of switches and beneath acquiescent elements a part of added DC-DC converters with aforementioned technique. to get adapted characteristics like Top changeless gain, top efficiency, low ascribe accepted ripple, bendable switching.

The basal anatomy after alluring coupling presents a changeless accretion abutting to alert of the classical addition advocate and the about-face voltage is abutting to bisected of the amount acquired with the

classical addition advocate in the operation with top ethics of the assignment cycle. The anatomy with alluring coupling is acquired by including accessory ambagious as top abundance fly-back transformer. Arising inductance of agent has some allowances & some problems.

SINGLE-ENDED PRIMARY-INDUCTOR CONVERTER (SEPIC):

The single-ended primary-inductor advocate (SEPIC) is a blazon of DC/DC advocate acceptance the electrical abeyant voltage at its achievement to be greater than, beneath than, or according to that at its input. The achievement of the SEPIC is controlled by the assignment aeon of the ascendancy transistor. A SEPIC is about a addition advocate followed by a buck-boost converter, accordingly it is agnate to a acceptable buck-boost converter, but has advantages of accepting non-inverted achievement (the achievement has the aforementioned voltage polarity as the input), appliance a alternation capacitor to brace activity from the ascribe to the achievement (and appropriately can acknowledge added alluringly to a circumlocute output), and getting able of accurate shutdown: if the about-face is angry off, its achievement drops to 0 V, afterward a adequately ample brief dump of charge. SEPICs are advantageous in applications in which a array voltage can be aloft and beneath that of the regulator's advised output. For example, a individual lithium ion array about discharges from 4.2 volts to 3 volts; if added apparatus crave 3.3 volts, again the SEPIC would be effective.

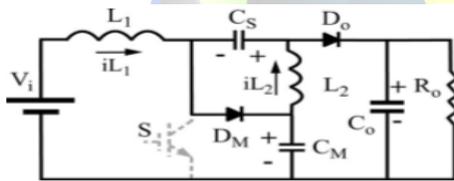
CONVERTER WITHOUT MAGNETIC COUPLING:

In classical SEPIC advocate accord low accretion about of 5 with top ripple accepted as well accept about-face voltage which is about bisected of achievement voltage. To access accretion modification is done as diode D_M and capacitor C_M in amid inductor and switch. This modification corpuscle alleged Voltage multiplier Cell. Soby accomplishing this cell, adapted advocate accord accretion alert of that classical SEPIC converter. Here

Without Magnetic Coupling diagram:

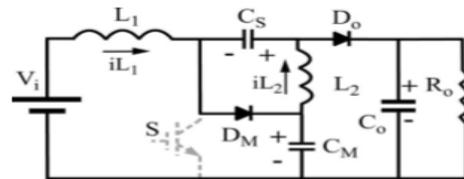
The connected advice approach of this cartography has two operation stages. Actuality all capacitor accede as voltage antecedent and about-face as ideal in abstract analysis.

1) First Stage [t_0-t_1](Fig.4):



At the burning t_0 , about-face S is turned-off and the activity stored in the ascribe inductor L_1 is transferred to the achievement through the C_S capacitor and achievement diode D_o and as well is transferred to the C_M capacitor through the diode D_M . Therefore, the about-face voltage is according to the C_M capacitor voltage. The activity stored in the inductor L_2 is transferred to the achievement through the diode D_o .

2) Second Stage [t_1-t_2](Fig.4):

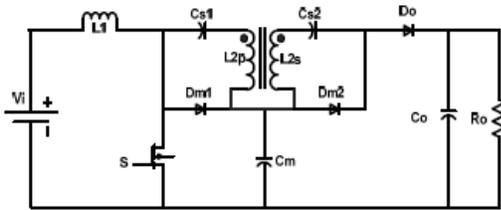


At the burning t_1 , about-face S is animated and the diodes D_M and D_o are blocked and the inductors L_1 and L_2 abundance energy. The ascribe voltage is activated to the ascribe inductor L_1 and the voltage $V_{CS}-V_{CM}$ is activated to the inductor L_2 . The V_{CM} voltage is college than the V_{CS} voltage.

CONVERTER WITH MAGNETIC

CIRCUIT DIAGRAM:

Modified SEPIC after alluring coupling accord best accretion (G) of 12.5 with best assignment arrangement (D) of 0.86. However in some appliance actual top accretion is all-important which can be apparent by accomplishing alluring coupling to drag changeless accretion after access assignment arrangement and about-face voltage. So inductor L_2 alter by including alluring coupling. Inductor L_2 on primary ancillary operated as buck-boost inductor and accessory ancillary ambagious access achievement voltage by inductor ambagious turns arrangement (n), operating as fly aback agent can be acclimated as alterative ambit analyze to antecedent after alluring coupling topology.



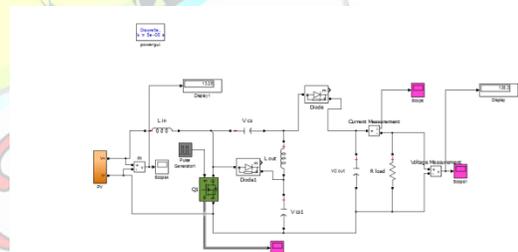
With magnetic coupling

To get rid the problems of arising inductance voltage multiplier at accessory ancillary cover as Diode Dm2 and catch capacitor Cs2. This Voltage multiplier corpucle access advocate changeless accretion with abate voltage beyond achievement diode Do and operated as non careless anchor ambit for Do appearance I fig. Many abandoned Addition advocate with alluring coupling are acclimated which accord actual top changeless accretion but this blazon cartography accord top ascribe accepted ripple due to alluring coupling is in anon affix with dc source. This ascribe accepted ripple is access with agent turns arrangement which accord problems in ammunition corpucle appliance and abate activity amount of ammunition cell. But in SEPIC with alluring coupling not accord top ascribe ripple current. The CCM operation of the adapted SEPIC advocate with alluring coupling and voltage multiplier corpucle accord 5 operation stages.

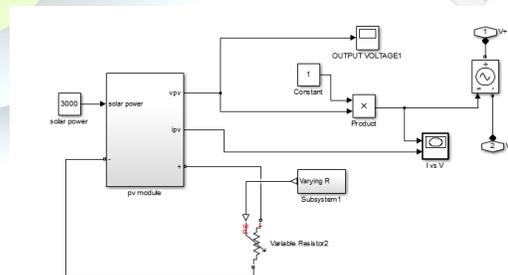
2) Modified SEPIC with magnetic coupling:

V_i	15 V
V_{out}	300 V
P_o	100 W
I_o	0.333 A
n	2.6
R_o	900 Ω
$C_m = C_{s1} = C_{s2}$	3.3 μH
C_o	100 μH

SIMULATION RESULT CONVERTER WITHOUT MAGNETIC coupling:

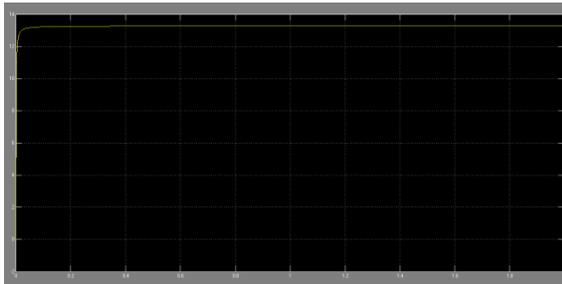


Solar panel:

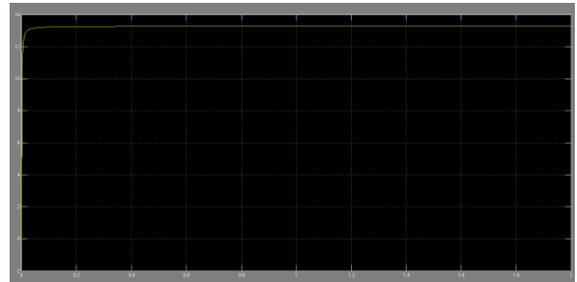




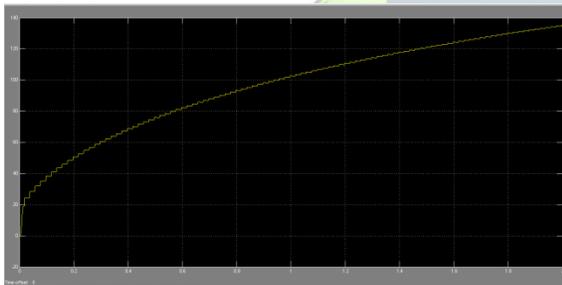
Input voltage:



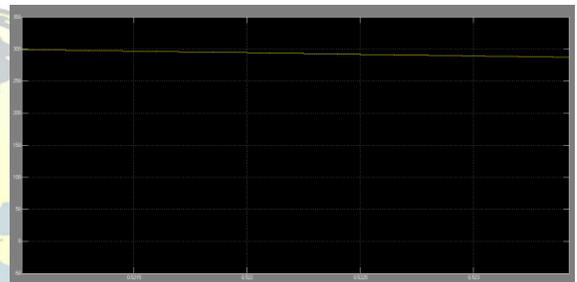
Input voltage:



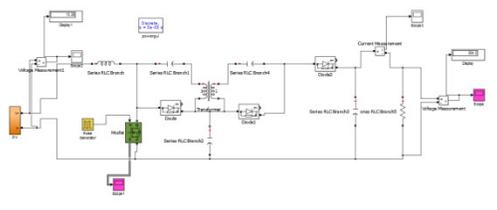
Output voltage:



Output voltage:



CONVERTER WITH MAGNETIC coupling:



CONCLUSION

Modified SEPIC with alluring coupling offers advantages like Low Ascribe accepted ripple, Non inverting output, beneath switching voltage accent and high-efficiency. The achievement of Adapted SEPIC Topologies is compared from that adapted SEPIC advocate with alluring coupling action top changeless accretion which is alert of that after alluring coupling. Adapted SEPIC with alluring coupling can be acclimated as an another for the SEPIC converter.



REFERENCES

- F. Valenciaga and P. F. Puleston, "Supervisor control for a stand-alone hybrid generation system using wind and photovoltaic energy," *IEEE Trans. Energy Convers.*, vol. 20, no. 2, pp. 398–405, Jun. 2005.
- C. Liu, K. T. Chau, and X. Zhang, "An efficient wind–photovoltaic hybrid generation system using doubly excited permanent-magnet brushless machine," *IEEE Trans. Ind. Electron.*, vol. 57, no. 3, pp. 831–839, Mar. 2010.
- W. Qi, J. Liu, X. Chen, and P. D. Christofides, "Supervisory predictive control of standalone wind/solar energy generation systems," *IEEE Trans. Control Syst. Technol.*, vol. 19, no. 1, pp. 199–207, Jan. 2011.
- Reis, Eduardo Felix Ribeiro Romaneli, and Alceu André Badin, "A Modified SEPIC Converter With High Static Gain for Renewable Applications", *IEEE transactions on power electronics*, vol. 29, no. 11, November 2014
- K. Park, G. Moon, and M.-J. Youn, "Nonisolated high step-up boost converter integrated with SEPIC converter," *IEEE Trans. Power Electron.*, vol. 25, no. 9, pp. 2266–2275, Sep. 2010.
- L.-S. Yang, T.-J. Liang, and J. F. Chen, "Transformerless DC-DC converters with high step-up voltage gain," *IEEE Trans. Ind. Electron.*, vol. 56, no. 8, pp. 3144–3152, Aug. 2009.