Performance Electromagnetic Bandgap in Core E Type Make High Frequency and Low Ripple

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Abstract

The Bandgap will make the system better than without use it and makes the efficiency bigger than before but it must be fixed with in the system need it. When the system doesn't fix will be influence with the duty cycle and bandgap, therefore obtained is output ripple current losses less than 10 percents.

If the system has the fix bandgap then its must calculate about the magnetomotans in the system, where the magnetomotans is one of the sources of the electromagnetic field. The big ripple must take from the trouble system. Then reduce the trouble system with the model system with the new one but don't change the size of the parameter before its.

Like as inductance, and etc. So the magnetomotans build the electromagnetic field and then joint to electromagnetic field in the bandgap has. The core of the magnetomotans are made from ferrite, the ferrite can make electromagnetic field. The parameter can be find any electromagnetic field in the system. The number of magnetomotans must created 2, 4, 6, and so on, as a function of the controlling system, and can make it more than one conductor, the conductor made from copper and make it the stranded coil with 50 degrees. For that reason so can be calculate parameter like the high impedance surface forms much parameters to the one thing about electromagnetic bandgap. In this paper the core E type model with six bandgaps. Take the trouble system with the Cuk converter.

In this paper for initial condition without use bandgap core type the efficiency about 4.3%, while the system use the bandgap will be 96% with the ring wire gauge about $r = 4.10^{-4}$ m, if we change the ring wire gauge about $r = 8.10^{-4}$ m, and the initial condition with no use bandgap core type is result of the efficiency about 7%, so the system use the bandgap can be reach 98%.

If the inductance from the system Cuk converter about $L = 8.2\ \mu H$, before modification, it found the ripple current more than 3%, then after the system was modify with for two inductance, with $L_1 = L_2 = 4.4\ \mu H$ can find the output ripple current as follows; before modify is 1.2% and After modification of the total output ripple current become 0.036%.

Index Terms – Bandgap, ferrite, core E type, low ripple high efficiency.

I. INTRODUCTION

UTPUT Ripple Current of prototype can generate noise of result produce for example at chemical process, current ripple permitted to minimize 2%. From research of current ripple can be minimized to become 0.036% [3] to minimizing of output current ripple can be improved to become 0% according to system [1] Winding of conductor can be stranded, so that yield high frequency, where this high frequency wired for ripple current output system become zero.

With approximation of magnetic circuit from result of modification [3], where magnet network use the core of ferrite can have the character of lumped [2] & [5]. bandgap as generating of magnet flux [2], in the reality interpose air can be utilized as a controller of input tension and of output [3] and even technology which used many in antenna and propagation can control system [7], operation of this system very determined by surface impedance, where surface impedance, studying bandgap, bandgap awaken dielectric [4] big size of dielectric determine operation of high frequency [6].

II. BANDGAP IN CORE E TYPE

Under consideration this paper, performance from 6 bandgaps, taken core of core E type, bandgap in core E type make dielectric bigger, be same with wired [4] which the modifier later

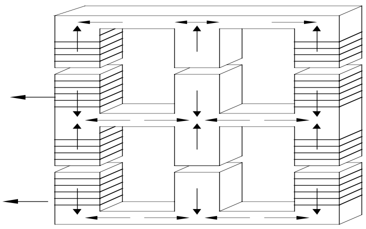

Fig.1. Core E Type with 6 bandgaps

From figure 1 core E type with 6 bandgap reckoned is big planned Cuk converter in this case taken by boost converter with input 9 volts [3] so that bandgap of each foot given 1 mm, with calculation of parameter in table 1.

From the core can be reckoned by approach of magnetic materials to electrics network [3] by reckoning value of reluctance eq. 1, capacitance and permeans [3]

$$\Re = \frac{l}{\mu A c} \tag{1}$$

After reckoned by figure 1 hence its rewrite at table 1.

TABLE I
VALUE OF RELUCTANCEI AND PERMEANS FROM E TYPE CORE

	Long Race (cm)	Large (cm^2)	Reluctance (AT/Wb)	Permeans (H)
Left Foot Core I_1	1	0.18	$0.442\ 10^6$	$2.262\ 10^{-6}$
Part II_1 Core	0.6	0.18	$0.265\ 10^6$	$3.773\ 10^{-6}$
Middle Foot core III_1	1	0.36	$0.221\ 10^6$	$4.524\ 10^{-6}$
Part IV_1 Core	0.6	0.18	$0.265\ 10^6$	$3.773\ 10^{-6}$
Right Foot Core V_1	1	0.18	$0.442\ 10^6$	$2.262\ 10^{-6}$

From fig.1. Reckoned by all parameter value there by reckoned also for foot [2] and [3]. With equation 1 reckoned also reluctance 6 bandgaps so that if taken by example of calculation of bandgaps for first feet hence table of like table II. Later changing reckoned by all gaps of take bandgaps start 0.1 until 0.6 mm.

TABLE II
ASSESS RELUCTANCE AND PERMEANS OF 6 BANDGAP.

$Bandgap_1$ (mm)	Large (Cm^2)	Reluctance (AT/Wb)	Permeans (H)
0.1	0.18	$0.00442\ 10^9$	$226.244\ 10^{-9}$
0.2	0.18	$0.00884\ 10^9$	$113\ 10^{-9}$
0.3	0.18	$0.0132\ 10^9$	$75.75\ 10^{-9}$
0.5	0.18	$0.0221\ 10^9$	$45.24\ 10^{-9}$
0.6	0.18	$0.0265\ 10^9$	$37.73\ 10^{-9}$

Later changing reckoned is big inductance of circuit Cuk converter in this case taken by L as according to inductance have problem, end then we replaced with the all parameter materials:

Writer take materials for winding made of copper materials, and the core E type we take from the ferrite with the following parameter as follows:

- Length primary side coil winding stranded of metal of l_1 = 3 m
- Length primary side coil winding stranded of metal of primary side winding strand of metal of l_2 = 3 m
- Length primary side coil winding stranded of metal from secondary l_3 = 3 m
- Length primary side coil winding stranded of metal on secondary l_4 = 3 m
- Radius of core E type in side primary stranded of metal radius of $r_1 = r_2$ = radius of core E type for in side stranded of metal radius of secondary $r_3 = r_4$, is differentiated to become eq. 3 :
  - $r_1 = r_2 = r_3 = r_4 = 4.10^{-4}$ m
  - $r_1 = r_2 = r_3 = r_4 = 8.10^{-4}$ m
  - $r_1 = r_2 = r_3 = r_4 = 16.10^{-4}$ m
- Effective input Primary length endwise stranded of metal of l_{1e} = input endwise stranded of metal effective length of secondary l_{2e} = 2.7 m, is obtained from :
  $l_e = \cos\beta\ (\ /2)$, where $\beta = 50^0$
  $l_{1e} = 3\cos(50^0/2) = 3 \times 0.9 = 2.7$ m
- Type copper prisoner $\rho = 1.72\ 10^{-8}$ ohm/m
- Permeability of air $\mu_0 = 4\pi.\ 10^{-7}$ Weber/amp
- frequency f = 25 KHz
- Conductivity copper σ = 5.8 107 Ω/m

Parameter above been adapted for by duty cycle with voltage regulation times like equation [2] and [3], in this case the high frequencies we find from design of bandgaps.

$$t_1 = \frac{\Delta I_1 L_1}{V_S} \tag{2}$$

$$T = \frac{1}{f} = t_1 + t_2 = \frac{\Delta I_1 L_1}{V_S} - \frac{\Delta I_1 L_1}{V_S - V_{C1}} = \frac{-\Delta I_1 L_1 V_{C1}}{V_S\left(V_S - V_{C1}\right)} \tag{3}$$

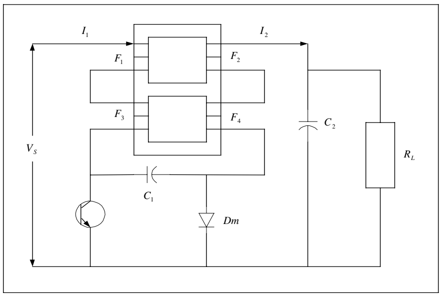

Fig.2. Modify Cuk converter with core E type six bandgaps

When all parameter, have been reckoned hence simulation through Psimval with the model like fig. 5. and fig. 6.

III. MAGNETOMOTANS [2, 5]

The winding evaluated as element two do or two connective polar tide approach of electrics network and magnetic network

$$\lambda = N\Phi \qquad (4)$$

$$i = \frac{F}{N} \qquad (5)$$

V and of I represent electrics field interaction and magnetic field which seen by fig.4. Polar electrics network four with parameter of hybrid [3] as the following equation 6:

$$I_1 = g_{11}V_1 + g_{12}V_2$$
$$I_2 = g_{21}V_1 + g_{22}V_2 \qquad (6)$$

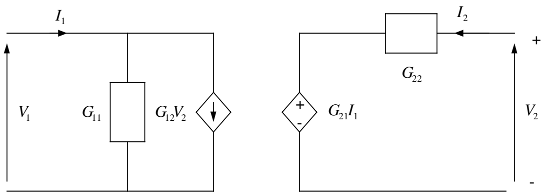

Fig.3. Electric circuit four ports

On fig.4. electric circuit four ports as direction of the reference for electric parameter of circuit magnetic made from ferrite where was calculated in table 1. as:

$$V_1 = r.i_2$$

Or

$$V_2 = r.i_1 \qquad (7)$$

Or with voltage control current source (VCCS).

$$I_1 = gV_2 \qquad (8)$$

or

$$I_2 = gV_1$$

The modification of equation with implementation as:

$$g = \frac{1}{R} \qquad (9)$$

While all parameter was calculate as a function of simulation parameter in Psimval. The ripple out is eq.10 :

$$\Delta I_2 = \frac{-V_a(1-k)}{f\,L_2} = \frac{k\,V_S}{f\,L_2} \qquad (10)$$

$$H = \frac{1}{g} \qquad (11)$$

The closer primer side of core coil transformer bandgap as fig.1. The gyrator circuit.

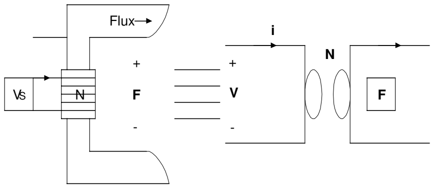

Fig.4. the Gyrator model transformation primary side of gyrator-capacitors

The modeling gyrator of primer side as the model Gyrator side of secondary:
Length primary side coil winding stranded of metal.

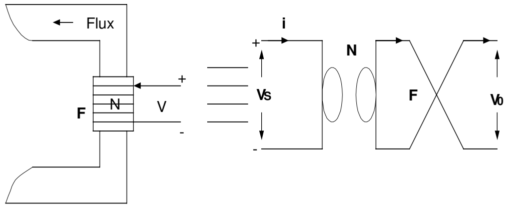

Fig.5. Gyrator model side of secondary transformation interposes air.

IV. ANALYSIS

Of bandgaps, 0.1 mm, 0.2 mm until 0.6 mm, taken by conductor parameter of core E type, coil winding of stranded with angle, corner of trended 50 degree, is later than reckoned by resistant value of gyrator, more bigger of resistant of Gyrator and hybrid so the result of the load is more smoothly or no ripple. And the time of steady state for that condition more quickly stable, is progressively disappear at magnet which smaller resistant.

The resistance of gyrator from the total approaching capacitance material ferrite and bandgap, at from R_G at table 1 and 2 , we find R_G = 0.2 Ohm, and then we simulated it so ripple out put about 2% with full load condition the ripple from eq.10. the ripple is 2.% for the initial condition with bandgap about 0.2 mm.

$$\Delta I = \frac{(82.598 - 80.938)x10^{-3}}{82.598x10^{-3}} x100\% = 2.0\%$$

While the bandgap about 0.4 mm, the resistant of Gyrator more smaller about 0.0128 Ohm. For the full load as figure .8. R_G = 0.0128 Ohm, its find the out put ripple 1.6%, to be the same with fig.9, we find the gyrator resistance about 0.098 ohm but the ripple bigger than before.

We find the total gyrator resistance with any variable , the best of total gyrator resistance must be appropriate with material, bandgap, and coil winding. Obtained of the ripple can be zero according appropriate all.

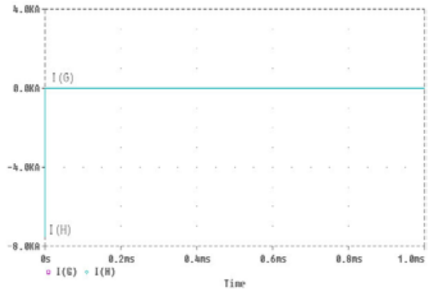

Fig.6. Graphic Current of Gyrator I_G and Current of Hybrid IH to Time for RG = 0.0128 Ohm

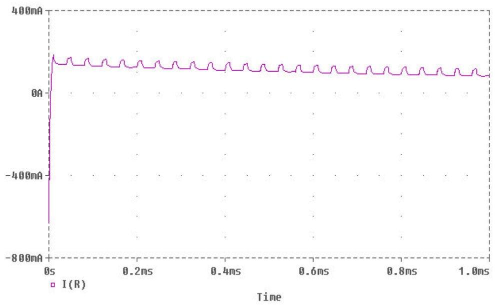

Fig.7. Graph load Current, for Time RG = 0. 0128 Ohm

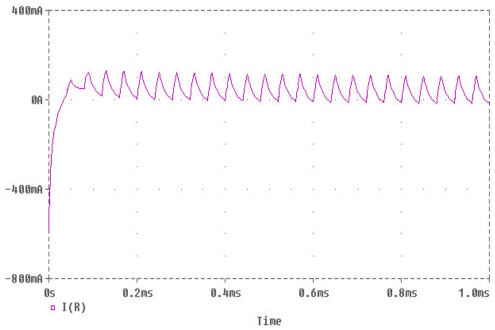

Fig.8. Graph load current with Time for RG = 0.098 Ohm.

Of this parameter can be seen by output current ripple we can see there is still ripple, because not yet been encumbered in an optimal fashion, from model fig. 7, searched by encumbering characteristic for the prisoner of gyrator include parameter of high impedance. After calculate the winding which stranded hence smaller ripple and more stable like fig. 8. Obtained efficiency about 98%.

V. CONCLUSION

With giving bandgap equal to 1 mm to six gaps hence output by using tables 1 hence model of ferrite E core type given by coil winding equal to r = 4.10^{-4} m, at condition of stranded of metal before we make stranded obtained the output current ripples equal to 1.8%, after stranded become 1.6%. If we take the different radius r = 8.10^{-4} m, at condition of endwise strand of metal before stranded obtained by current ripples equal to 1.6%, after stranded become 1.4%. If we take r = 16.10^{-4} m, at condition of stranded strand of metal before stranded obtained by current ripples equal to 1.4%, and after the stranded ripple become 1.2%.

Total resistant gyrator from 0.4 mm bandgap, have high frequency 25 KHz total efficiency of E type of material ferrite become 98%, with the total output ripple current is 0.036%.

The total resistant Gyrator depends on the load.

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