# Influence of Inverter Excitation on Iron Loss of Non-Oriented Electrical Steel

UESAKA Ma an  $^{\ast_1}$  OMURA Ta e  $^{\ast_2}$  SENDA K in  $^{\ast_3}$ 

## Abstract:

and  $c \in e$  defects of a is a single constant of the set of the

## 1. Introduction

and, receorcaree edarcy, rc cy, area a e a e ecredir com brei zy, ed e -Bezy, anceonomere - Bedy, r.

In  $\mathcal{F}$  -etal cenc $\mathcal{A}$  i and and etal cence, i an anial e  $\mathcal{A}$  and and ded and e lage a etal  $\mathcal{A}$  and each  $\mathcal{A}$  and  $\mathcal{A}$  c ang  $ed^{7}$ . Yon , . e ciediei ece i ige a  $ell_{A}$  a org PWM on eie Boed i d. Beeni ON ige organisme on general, and e ied i ai on a ed ced b dec ea orgi e on eie ON ige<sup>8</sup>. Ba ed on i e e e i, i can be a di ai a deia ed on de ian dog Di e elloci Di e e

ce and i eque a papen i equen in in beinece a en e a aving in inde PWM in eve e cravin cindvin . Te e el e, e

### 2.2 Experimental Results and Discussion

Figure 3 เ 🛛 🗐 ા de ા da e c -ાતા ગા ભારબુ તે 🐴 🐴 🦓 આ ભાર 🕅 den i  $B_{\rm c}$  1.5 T and  $I_{\rm c}$  enc.  $B_{\rm c}$  enc. 50 H,5, and ie in ande an ere e crar an ା Cମ ις, aganeiς, a 🖌 🖌 den ι B 1.5 T, v e Bunda enta Be enc 50 H,5, v e ca e . 🛛 e en c c 1 H5andre, d ar in inde 0.4. It can be Inder drar In deceae inde bi in da e ciai mandon e i e e ciai ma i e e e i c me deceae, and le m ade a eve e ciai a zecz a ed i i ai aide ai da eciai ગ.Fic, e,ie, ગા.શીcangeon ગ ଌ୦୦🗛 ଥର ସମ୍ବେମ୍ବ ସା ବେଧାର ସାବ а age ande an ele e clai an lan ande an da e crai .m.





Fig. 4 Influence of carrier frequency on inv

 $a_{a}$  e a i e celi come om c ea ed b i dec ea ed a ieca e 📓 e enconcea ed. M e e, iecange лbı andre an anceae ave becare **.**1 a<sub>f</sub>e a ca e . Be ence be 5 H.5. Figure 6 vec angeon on an ande an eve e cenica a A a deni B, Blanda eniai Ji ra Ble enc and ca e Ble enc cae Bledar 1.5 T, 50 H,5 and 1 H,5, e ea e, and a dacanged.In deceaedare i an an de d at an and e and e ed. Figure 7 ιe eain beienig daimade and te an esnceae ale suc. Te su inceae ale deceaeda i 😋 d ai minde inceaed, b i beca e contantata dator on de e 1.6 a<sub>₫</sub> e grade Due eeu come.



Fig. 5 Influence of carrier frequency on inc



Fig. 6 Influence of modulation index on inv



Fig. 7 Influence of modulation index on inc

Figure 8 iecangean eicagi Blie 🔺 aganete 🛛 e d 🛆 H 🖉 t 🖕 an 💦 a and O T and  $\iota \in \mathcal{A}$  and  $\mathcal{A}$  and  $\mathcal{A}$  and  $\mathcal{A}$  and  $\mathcal{A}$  and  $\mathcal{A}$ in ele e clalin cindlin and eell cine e.A ieca e 🛛 e encandie, daimende deceae, i e 🔉 🛛 an i 🗷 c angre an i 😋 agan ei c.🕅 den i  $\Delta B$  and i e i engli . A i equation of  $\Delta H$ beca e afe. H e e, en i e een come a ed ced, a. in cange a be eduica ini  $\square$  cange in  $\square$  again et c.  $\square$  den  $\square$   $\Delta B$ , bit e cange on the tength . But  $\mathbf{c}_{\mathbf{A}}$ , agonetic. Bed  $\Delta H$ dec ea ed. Beca e venden c c d be c an El ed an aigum, i guane age deceae an an anderan ere e craran en ranane eer ee ed co ed beca erecangemre ιας Aις again et c. A e d  $\Delta H$  . Aις a deceaeddei ie ed ci m 🖉 eei i cine, amd deceaed b an a suc e sudage e ា dec ea e a  $\Delta H$ .

Ner, an derea arere eer cone de endence  $\square$  edd conr and reconde on ere e craron, re reconsere B-Hon conce $A_{A}$  on  $a_{A}$  ea edbre $\square$  on  $de_{A}$  on  $a_{A}$  ea edbre $\square$  -

Wenay on Lay ed, ion on iai iee abbecied bie group  $B_1$  Blicg on and  $c_{4}$  as an ide  $\mathbb{A}\Delta B^{10,11}$ . Tec  $e_{1}$  e, ie  $c_{1}$  and ie e e a an  $B_{2}$   $\mathbb{A}$  and  $c_{4}$  and  $B_{2}$ 

 $\mathbb{A}_{\mathcal{A}_{1}}$  edbore e cratoria e ead, te rage conted tation, agoneto, a den ta e  $\mathbb{A}_{\mathcal{A}_{1}}$ But the reference of early and the redatte  $\mathbb{A}_{1}$  or  $\mathbb{A}_{2}$  early agoneto, and a tarion of the rest of the re

Figure 16 i e aci a a e 🗷 🗈 ा de in ele e clalin and le e 🙀 aled a e 📓 in . El eac …El e…ele enc grun. Teeya aued a e A n ee a ca a edi i e aci a caed a e. It in intation genera inceae inde decic en (DC) baed, aginer, 5a- $\iota$  a a  $\iota$  a back  $a_{f}$   $a_{f}$  aTecele, inceace ele al in elle in Blay inconte ed inde a bay ganery ar be, a can de ed i be indee y aied bieiec in e ed e e. H ee, i e ien den c. 🗷 i e 🙀 aied. 🛛 🚜 i e ecia cze ineni 💩 cze agineric 💩 den ra ang dag en li leacha cange an an a caled l cange in leca e 📓 e en cand 🗛 davanande, 🛒 evang varvea ac ed ee ຝ 🛽 ାde land ସମୁଦ୍ର ସେ 🙀 ସେ ସା 🖉 succeaced su der succear su.

 $F_{A}$   $F_{a}$ . 16, i can be order draiteorea e on on a lage encome e becare e gan Blean i and e e chai an canditan i  $f \in A_{4}$  dat an and e e. M. e e, a far an an  $F_{f}$ . 15, i e an tan i B  $A_{4}$  and  $C_{4}$  and  $C_{4}$  and  $C_{4}$  and  $C_{4}$  and  $C_{4}$  and  $C_{4}$  decease entry data and e and ead  $A_{4}$  decease entry data and e and ead  $A_{5}$  for a first bea can a be at bredit a decease and e at B edd c entry i an .

Tecangen n ence eucone a cangeda becare e noncedonde eciai nondin i a grae Me enc. A m i ecae Mic, dain nde, i enicen i Magonoca, onenia deceae onde a grae Me encoordion, ondoaiongiai dei a deceae once ai Meddo eni i on .

# 3. Effect of ON Voltage on Iron Loss under Inverter Excitation

## **3.1 Experimental Procedure**

T e e, en a ca ed  $b_{A}$  agenere, eagen en a ge a es - N c and e IGBT on ere c c ra ree crai en ce. Figure 17 re, ea gen ref. Tea e age ON rage onead  $B_{A}$  re rage a  $eB_{A}$  on ref. agenere, eagen a 1.2 V, and rerage  $a_{A}$  agenere den r a braned b ad regre DC e V ce rage  $b_{C}$ . F  $c_{A}$  a en a e car e e  $eB_{A}$  ed r an e crai on e ce concaree eer rarcone 10.35, ramp a e ramonome da ere 13.5, and an re da ere 15.5, a e a edb e cruong, on eredon a acera ong cae rarcone 1114, and a a ondong 1100 rom and econda ondong 1100 rom e e a ed. In repea e enr, re ar 10 on and DC a canged b cangong reona be 10 an ared a e eer re ree e 113 eer, 22 eer and 55 eer.

## 3.2 Experimental Results and Discussion

 Figure 18
 ice ear in
 belcear ie

 c
 - ecrimataea
 Bire and ecrimataea

 in
 Air and arguing in the PW.5 (M)/T1 in 15 (in )-1.3 (in )0.8 (in )0.5 (in )-1 (in )0.8 (in )0.5 (in )0.8 (

iee dei e im Ela, mcc, menimic, graneic, Elden i a e El, Mee, i a i finale bec, e afe a ie equenc - ecima a eabec, e a a e beca e iea ea Elic, moncea e andiemic, en El iee dei e im Elice a, mc ca menimic, graneic, Elden i a e El, mcea e ande i candian. Sance, an a e a iEl, ed a de PWM area a Ele e ciaian, i can de ed bei ed cice, ea ed an if dace ac El, ie an Eleac eci biamed, El, ie FFT ana .

## 4. Conclusion

Ing i degan, i ga ianii can degaga aneiga ea ga en ande i e eBBeci Blie aga an c ca ed ban e ie e ciaian. Fog i e ani, i e Blag an edge a biaaned a a e i Bli id.

(1) It a on antiate tatte at Bledd cent to an detteeBBect Blag, and age onde on ele ectatorian onde on da ectator. Baledon to Bondorg, to con de edite edd cent ed croneBBect Blorg to onne ce agate a geogram Blean to a ele ectator tanonde on da ectator.

(2) Te ecentage B and a concept anent and ded an i end againet c. El den i a ella decea ed a i e ca e Be enc and i end de ancea ed.
It i gritatie at Bedd c ent i an decea ed. El i ea an, and a a e i, i e eet i cane de endence B an beca en a e.
(3) I an ancea ed a i e at Bielon i agei i eDC i age Bielon ete ancea ed.

(4) I an ande PWM e charan candian i i an ON lage c d be edoued i g d acc ac  $\mathbb{B}_{\mathcal{A}_{i}}$  i e  $\mathbb{B}_{i}$  e enc  $\mathbb{C}_{\mathcal{A}_{i}}$  and  $\mathbb{B}_{i}$  e  $\mathbb{C}_{\mathcal{A}_{i}}$  and  $\mathbb{C}_{i}$  again e i  $\mathbb{C}_{i}$ den i a e $\mathbb{B}_{\mathcal{A}_{i}}$ . On i e i e and, and e an e i e e charan candian, d egrence cc ed be een i e  $\mathbb{A}_{i}$  ea ed a e and edoued a e  $\mathbb{B}_{i}$  an beca eresticeaes trie deration  $\mathbb{A}_{\mathcal{A}}$  and  $\mathbb{A}_{\mathcal{A}}$  are educed to the ON rate as the trian trian

## References

- Ta a a\a, R.; Wa , S.; A<sub>4</sub>, a, T.; M a\a, K.; N<sub>4</sub>, a, K.; Sen , M. Ba c S d -n L Fac. E a a -n BC -n cenvaled W-nd-n<sub>2</sub> Pe<sub>4</sub>, an en Ma<sub>2</sub>-n e S -n c b M · . IEEJ Tan acc -n -n Ind · A cal -n . 2013, . 133, -n . 12, . 1148, 1156. (-n Ja an e e)
- 3) K. I. A a ; Sa , H.; A a , a, S.; I a a, K.; Te i a
- ⊠ 926-стЕ (12) 8Ссі54 09а RD+2P) 63 BB 543 TE /Амосб 09 Tл 1С7Т АВ EV (слаб.) II 6-л. Тъс 8:0-л 853-26.058 582.2986 Т п. d. \_\_\_\_\_\_\_ IEEE T ал . Маз-л. 1990, ... 26,-л. 5, ... 1969, 1971.