04.05.2023

Subject: Response to Revision of TPEL-Reg-2023-02-0439.R1

Dear Prof. Yaow-Ming Chen

Thank you for your letter and the opportunity to revise our paper titled "Variable Carrier Phase Shift Method for Integrated Contactless Field Excitation System of Electrically Excited Synchronous Motors". The revisions offered by the reviewers have been helpful, and we also appreciate your insightful comments. The paper has been improved by the reviewers' comments. We have included the response to the reviewer's comments immediately after this letter. The modifications and additions are highlighted in the main text. We deeply appreciate your consideration of our manuscript.

Kind Regards

Assoc. Prof. Ozan Keysan

Reviewer 1:

- **Reviewer Comment**: Thanks the author for putting together a nice paper. It is a very interesting work.
- **Response**: Thank you for your valuable feedback. We have carefully reviewed your comments and made the necessary additions to our paper. Specifically, we have addressed the points you raised and made several additions to the paper to improve its clarity and completeness.
- **Reviewer Comment**: In terms of content, the authors need to provide derivations of all of the equation in your paper, especially the math-heavy equation (1-8). The full derivation can bedone in appendix, with more detailed explanation of equation in corresponding section.
- **Response**: Thank you for your helpful comments. In response to your feedback, we have expanded the derivations in our paper to include intermediary steps. These expanded derivations are now highlighted in the main text for ease of reference. Specifically, you can find them in Section II and Section III of the paper.
- **Reviewer Comment**: Technically, I wonder how the WPT system is tuned. In equation (16), the capacitance is compensating the inductance. But what does this mean in terms of the voltage (field) gain and the output power on the secondary side. This is useful for future design
- **Response**: Thank you for your comments. The gain at the resonant frequency depends on the coupling, Tx, and Rx coil, and it does not directly depend on the capacitance value. However, the capacitance can still affect the resonant frequency when other parameters are held constant. In response to your comment, we have also updated the WPT design section of our paper and added subsections for the analysis and design steps. These changes are now highlighted in the main text of the paper and can be found in Section IV.A and Section IV.B.
- **Reviewer Comment**: I would also be interested in the specific control used in the paper. Based on figure 8, it would be nice if authors can include the parameters and control block diagram.
- **Response**: Thank you for your valuable feedback. We have made some updates to our paper in response to your comments. Specifically, we have added the control diagram and parameters to Fig. 9 and provided an explanation of these elements in the main text of the paper. These changes can be found in Section III.C.
  In addition, we have included an experiment to observe the dynamic control responses of the system. The test and results are discussed in Section V.E of the paper.
- **Reviewer Comment**: In terms of figure, I would recommend author use larger fonts. They should be close to the size of the fonts in the paper. This problem is prominant especially infigure 12.
- **Response**: Thank you for your comments. We have made some updates to the figures in our paper in response to your feedback. We have also highlighted the updated figures.

Reviewer 2:

Thank you for your valuable feedback. We have carefully reviewed your comments and made the necessary additions to our paper. Specifically, we have addressed the points you raised and made several additions to the paper to improve its clarity and completeness.

- **Reviewer Comment**: 1. This method may actually increase the control complexity. Will the proposed control method be better than independent drivers in terms of efficiency?
- **Response**: Thank you for your comments. The drive total losses increase because of the high-frequency current, but this loss increase becomes minor and can be overcome by good thermal management. To discuss this issue, the drive losses are measured experimentally and interpreted in the main text. This can be found in Section V.F.
- **Reviewer Comment**: 2. Whether the proposed VCPSM control strategy will affect the motor stator current needs to be supplemented with stator current experiments.
- **Response**: Thank you for your comments. The proposed method increases the first switching voltage harmonic, but thanks to the high inductance of the stator winding, it is filtered out in the current. The impact of the proposed method on the stator current is discussed by the experimental result in Section V.D.
- **Reviewer Comment**: 3. Closed-loop dynamic testing experimental results are needed, to verify the control effect on the current excitation current.
- **Response**: Thank you for your comments. Closed loop dynamic tests are made by means of a step change in field current. The results and discussion are given in Section V.E. However, it should be considered that more responsive control could be achieved by adjusting controller parameters, and in this paper, the optimization of controller parameters is out of scope and not studied in depth.

Reviewer 3:

Thank you for your valuable feedback. We have carefully reviewed your comments and made the necessary additions to our paper. Specifically, we have addressed the points you raised and made several additions to the paper to improve its clarity and completeness.

- **Reviewer Comment**: 1. Section 4 "The design of the WPT system" is somewhat simple. The author should further describe the design idea of system parameters and whether different parameters affect system performance
- **Response**: Thank you for your comments. We have expanded the design section of the paper and added information on the effect of various parameters. The changes have been highlighted in the main text of the paper in Sections IV.A and IV.B.
- **Reviewer Comment**: 2. The switching frequency of the motor drive is 65 kHz, but the resonant frequency of the WPT system is 56.7 kHz. The author should explain it.
- **Response**: Thank you for your comments. The switching frequency is selected as 60 kHz. The calculation of the resonant frequency and other WPT system parameters is improved and it is discussed in Sections IV.A and IV.B. In our experimental setup, our parameters slightly deviated from the designed values due to manufacturing tolerances, but it does not affect the performance.

- **Reviewer Comment**: 3. The "Fig. 3" on line 52 on page 3 of the paper should be Fig. 4. The authors need to revise it.
- **Response**: Thank you for your comments. It was corrected. (Previous Fig.4 becomes Fig. 5 in the revised manuscript.)
- **Reviewer Comment**: 4. The format of Figure 9 is not standardized. The authors need to revise it.
- **Response**: Thank you for your feedback. Previous Fig. 9 (Fig. 10 in the revised manuscript) has been updated accordingly.
- **Reviewer Comment**: 5. The meaning of the waveform should be marked in Fig. 12. At the same time, the graduation values V/div of C1 and C3 in the lower left corner should be changed to A/div.
- **Response**: Thank you for your feedback. Previous Fig. 12 (Fig. 14 in the revised manuscript) has been updated accordingly.