MT 26
International Conference
on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1428** Type: **Poster Presentation**

Wed-Mo-Po3.13-08 [116]: Analysis of Novel Wound Field Flux Linear Reversal Machine with Multiple MMF Working Harmonics

Wednesday 25 September 2019 09:30 (1h 45m)

Due to the application limitation of permanent magnet and the ever-growing market requirement on linear motional equipment, the wound field linear machines are still drawing much attention. In this paper, a novel wound field flux reversal linear machine (WFFRLM) is proposed, which has both excitation windings and armature windings on a dual-side primary core, offering high thrust density and suitable for long-distance application. The pole shoes of the proposed WFFRLMs are specially designed with different pole pitches, introducing additional working magnetic motive force (MMF). As a result, the machine can operate on multi-MMF working harmonic mode, which means multiple orders of MMF are utilized, and by the flux modulation functioned by secondary iron poles, all the resultant working orders of air-gap flux density can contribute to the fundamental back electric motive force (back-EMF). Since the magnetic field strength is not enhanced but the MMF is better utilized, the proposed machine can accordingly enhance its electromagnetic performance, including the thrust force density and power factor. To clarify and verify the superiority of the proposed WFFRLM, the configuration of the proposed machine is firstly introduced and the analytical equations of the electrical excited MMF, air-gap flux density and back electromotive force (EMF) are derived and compared to that of the regular WFFRLM. Then the performance of the proposed machines with different excitation/armature pole pair combinations are analyzed to figure out the best one for the WFFRLM. Moreover, the influence of the key geometric parameters including slot opening ratio, different ratio of excitation pole pitch, size of secondary iron poles are investigated to achieve maximum thrust density and power factor. Finally, the well-optimized WFFRLM is modelled and compared with a conventional WFFRLM. The results show that the proposed WFFRLM can yield 18% higher back-EMF and 13% larger thrust force than the conventional one.

Authors: ZHOU, You (Huazhong University of Science and Technology); GAO, Yuting (Huazhong University of Science and Technology); Prof. QU, Ronghai (Huazhong University of Science and Technology); CHENG, Yi (Huazhong University of Science and Technology); SHI, Chaojie (Huazhong University of Science and Technology)

Co-author: ZHANG, Yuanzhi (Huazhong University of Science and Technology)

Presenters: CHENG, Yi (Huazhong University of Science and Technology); ZHANG, Yuanzhi (Huazhong University of Science and Technology)

Session Classification: Wed-Mo-Po3.13 - Motors X