Contribution ID: **14** Type: **Poster Presentation of 1h45m**

A transverse flux single-phase tubular switched reluctance linear motor

Monday 28 August 2017 13:15 (1h 45m)

A transverse flux single-phase tubular switched reluctance linear motor (TF-TSRLM) is proposed in the paper, and it is compared with the longitudinal flux single-phase tubular switched reluctance linear motor (LF-TSRLM) in electromagnetic thrust. The stator consists of five ferromagnetic rings that are divided by four spacer rings. On the cross section of the TF-TSRLM, a stator ferromagnetic ring has six poles with coils winding on. The mover threads through the tubular stator rings. Different from the LF-TSRLM, the interval sleeves which break the mover tooth rings are made by non-ferromagnetic material for isolating any longitudinal flux. When the windings are excited, magnetic lines of force form closed loops through stator poles, air gap, mover tooth ring, and stator yoke. The plane where the surround magnetic flux paths exist is perpendicular to the mover movement direction. four structures with respectively 2 poles, 4 poles, 6 poles, and 8 poles on the cross section are proposed. The poles of structures with 2 poles, 4 poles, 6 poles, and 8 poles are distributed uniformly at 180°, 90°, 60°, and 45° intervals respectively. The sensitivity analyses were made on some parameters to achieve new dimensions with better thrust performance, such as different stator yoke thickness, different mover cylinder's thickness, different stator pole width, different pole width ratio. In the analysis process, the excitation current is fixed as 15A. After the sensitivity analysis on four important parameters, the final dimensions of proposed TF-TSRLM are determined. The electromagnetic thrust curves of LF-TSRLM and TF-TSRLM with final dimensions are calculated by 3D FEM in3A, 6A, 9A, 12A and 15A respectively. It shown that the electromagnetic thrust of transverse flux single-phase tubular switched reluctance linear motor with 6 poles is greater than that of longitudinal flux single-phase tubular switched reluctance linear motor at the same excited current values.

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Session Classification: Mon-Af-Po1.04

Track Classification: E1 - Motors