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Wed-Mo-Po3.12-11 [106]: A Novel Three-phase Tubular Switched Reluctance Linear Machine with Transverse-flux path

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Several tubular switched reluctance linear machines (TSRLMs) with transverse flux are proposed for improving thrust density recently. Owing to the particularity of the structure of transverse-flux TSRLMs, how to maximize the electrical utilization becomes a key to improve these machines'performance. A novel three-phase transverse-flux TSRLM is proposed in this paper, whose stator sleeve is composed of six ferromagnetic rings and five spacer rings. And the mover is composed of an aluminum tube and several fan-shaped poles. The adjacent fan-shaped poles are placed at 120 degree intervals. The novel structure permits that the winding coils can be all through connections. This winding way helps addressing the problem of the coils placement that exists in other transverse-flux TSRLMs. In order to verify superiority of the novel TSRLM, a conventional transverse-flux TSRLM which has the same main dimensions is presented. The three-dimension finite element models of the machine electromagnetic field is established. The model and its boundary are shown-Finally, the finite element calculation results show that the average thrust per unit core mass of proposed TSRLM is greater than conventional TSRLM. With the flux linkage data and co-energy data calculated by FE software, the dynamic simulation models of both TSRLMs are established in MATLAB/Simulink. The electrical simulations and generated simulations are conducted with these models. The closed-loop speed regulation simulations are conducted, which utilizes the PI regulator. In the PI regulator, the proportion coefficient is 7, and the integral coefficient is 15. In addition, the generation simulations with separately excited topologies of power converters are conducted. The power supply is 36V. The operation velocity is 2m/s. The current waveforms and output power waveform are presented. It proves that the novel structure can help increase the electromagnetic utilization of TSRLMs. It can be found that the ability in electromagnetic energy conversion is stronger. Thus, if one linear machine is used as a generator in direct-drive system, the structure of machine is a strong candidate.

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