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Thu-Mo-Po4.14-08 [115]: Analysis and Experimental Test on a Permanent Magnet EDS System Employing an Annular Halbach Structure

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With the rapid development of rare earth materials, the permanent magnet electrodynamic suspension (PMEDS) technology has met a new development opportunity. This paper presents a study on a special PMEDS system named as an electrodynamic wheel (EDW). In the PMEDS system, an annular Halbach permanent magnet array is designed and rotated above a flat aluminium sheet. We establish a simplified 2D and 3D finite element model by the ANSYS Maxwell, and the structural parameters of the EDW and the aluminium sheet were optimized. The relationships between the rotational speed, geometry size of the EDW, pole pairs, thickness of the aluminium sheet, and the lift-to-thrust ratio, lift-to-weight ratio were analyzed. Then, the dynamic force characteristics of the PMEDS system under different rotating speeds and levitation gaps were verified through the dynamic running experiments. This work reveals that the PMEDS scheme is feasible based on an annular Halbach structure and can achieve the stable suspension and propulsion forces.
Keywords: Permanent magnet electrodynamic suspension, Annular Halbach array, Electrodynamic wheel, Force characteristic

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