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Thu-Mo-Po4.13-07 [102]: Numerical study and optimization for a prototype EDS maglev system

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In this work, the two major electrodynamic suspension (EDS) methods for transportation, namely the permanent magnet - metal plate method and the superconducting magnet - null flux ground coil (figure 8 coil) method, are studied analytically and numerically. Numerical models in different scales were built and the performances of levitation force, resistive force, characteristic speed, et al. are compared.
This study aims for a design of an EDS prototype system including a train weighing 1.2 t, which levitates at 15 m/s. It is shown that at smaller scale, the permanent magnet based EDS system is preferable due to 1). Without cryogenic requirements, the system is less complicated and the design is more flexible; 2). The effective air gap is smaller since no cryostat presents. However, with increasing scale, the superconducting EDS system becomes more attractive due to the larger magnetic moment of superconducting coils. The advantages include: 1). Lower operating energy dissipation; 2). Larger possible levitation distance; 3). Smaller weight and size of the magnet itself for even larger scale applications. The superconducting EDS route was picked for this project, which is proposed to be built in one year. Based on the numerical studies, the superconducting magnet and the corresponding null flux coils are specifically optimized for the size and speed of the project. The effects of the geometry parameters of the superconducting coil and the null-flux coils, especially the cross-section and the pitch of the null-flux coil will be presented.

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