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Numerical study on dynamic characteristics of stack-type HTS Maglev system based on H-formulation

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With the merits of passive stability, energy-saved and environment-friendly, high-temperature superconductor (HTS) magnetic levitation (Maglev) is regarded as a promising candidate for the future high-speed transit. Amont the two main HTS maglev methods the bulk-type and stack-type, the stack-type HTS maglev is of the merits of larger engineering current density, larger loading potential and flexible size. In recent years the dynamic characteristics of bulk-type HTS maglev system has been well studied, however, there is little researches about the dynamic characteristics of stack-type HTS maglev system to our best knowledge. Limited by the experimental conditions, numerical methods are generally employed in most of the current research on dynamic charactristics of HTS Maglev. Thus the ultimate goal of this paper is to build a numerical model to advance the understanding of the dynamic charactristics of stack-type HTS Maglev system. A strong-coupled electromagnetic-thermal-mechanical model based on ***H***-formulation was built to study the dynamic response, in which the non-linear electromagnetic characteristics and the thermal characteristics of the HTS tape were taken into consideration. To predict the dynamics of the system, the relative movement between the HTS and the permanent magnet (PM) is modeled using time-dependent Dirichlet boundary conditions, while the position is obtained by solving the equation of motion. The dynamics and temperature rise of the stack-type HTS maglev system were studied, with the different time-varying external magnetic fields imposed on the stack magnet of the HTS tape, which refer to the guideway irregularity. The influences of guideway irregularity were studied to restrain vibration, so as to improve the system stability. The results of this paper will play a positive role to suggest the viable measures for improving the stability of the stack-type HTS maglev system.

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