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Levitation and guidance forces of CC-tape stacks

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For the development of CC-tapes based bearings and transportation systems it is important to have not only information on the levitation force, but also the data on stability of the system in response to the lateral displacements. This work continues series of studies on the levitation properties of CC-tapes stacks and primarily focuses on the guidance force. In our report, we present new results on investigation of both levitation and guidance forces of CC-tapes stacks subjected to different lateral displacements above a permanent magnet. In the measurements we used 12 mm wide commercially available CC-tape manufactured by SuperOx. The tape were cut into pieces 12 mm x 12 mm. The number of layers in the stack ranged from 5 to 200. For stacks magnetization we used 8 T superconducting magnet. The experimental investigations on the influence of lateral displacement on the levitation performance of stack of various thicknesses with different various fluxes were processed in this work. In addition, effect of measurement height and maximum lateral displacement distance on the guidance force was studied. Results show that both trapped flux and stack height have much influence on the guidance force. The increase of trapped magnetic flux leads to a larger lateral restoring force. Hysteresis of the restoring force of the stack was observed. The hysteresis increases with decreasing of measurement height. Smaller lateral displacement may lead to the elastic lateral motion of the stack. The influence of lateral displacement distance on the relaxation of both levitation and guidance forces were studied. The rate of change of levitation force and guidance force was different for different maximum lateral displacements. The experimental results were compared with the results of calculations performed using COMSOL Multiphisics. The analyses and conclusions of this work are useful for the practical application in magnetic-force-based systems.

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