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M2Po3D-03: Modeling and Analysis of Magnetization in ReBCO Coated Tape Conductor and Helical Wound Tape Conductors

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This study presents a comprehensive analysis of magnetization in ReBCO-coated conductor tape and helical wound tape conductors using both numerical and finite element method (FEM) approaches. Magnetization is a crucial factor limiting the practical application of superconducting cables and coils, and accurate prediction and minimization of magnetization are vital for the development of superconducting systems. Numerical models were developed to predict the magnetization behavior of ReBCO-coated conductor tapes and helical wound tape conductors. These models were validated by comparing their results with analytic models and previous experimental data. The numerical simulations enabled the calculation of the M - H response, allowing for the estimation of hysteretic losses. Complementary FEM simulations were also performed to investigate the magnetization behavior of ReBCO-coated conductor tapes and helical wound tape conductors. A diluted superconductor approach was employed for the FEM modeling. The FEM simulations explored various twist pitch values and demonstrated a reduction in losses consistent with the analytical expectation of $2/\pi$ reduction from flat tapes in fully perpendicular fields. The combined numerical and FEM studies provide a comprehensive understanding of magnetization in ReBCO-coated conductor tapes and helical wound tape conductors, offering valuable insights for the optimization of superconducting cables and coils.

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