

Modeling cryo-magnets

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Abstract

Cryomagnets can be made by applying a pulse of magnetic field to cooled bulk superconductors, resulting in a "trapped field" that can reach several teslas. These easily transportable devices could be used in many applications, in particular magnetic levitation and motors.

We analyze the theoretical models proposed; these are based on Maxwell's equations and a constitutive equation which is usually Bean-Kim. In particular, we show that they cannot yield amplitude dependant effects and this is contrary to the experimental observations of "giant flux jumps". A solution to this is to couple directly Maxwell's equations to the Ginzburg-Landau free energy and derive a Maxwell-Ginzburg-Landau Lagrangian for the vector potential and the order parameter. We discuss this new model and present 1D and 2D simulations.

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