THE UNIVERSITY OF CHICAGO | THE COMMITTEE ON COMPUTATIONAL AND APPLIED MATHEMATICS

MANAS RACHH

Center for Computational Mathematics
Flatiron Institute

Static Currents in Type-I superconductors

THURSDAY, March 31, 2022 at 4PM
Jones 303, 5747 S. Ellis Ave. Chicago, IL 60637

In this talk, we describe the classical magneto-static approach to the theory of type-I superconductors. The magnetic field and the current in type-I superconductors are related by the London equations and tend to decay exponentially inside the supercon-ducting material with support of the fields contained primarily in O(λL) neighborhood of the superconductor. We present a Debye source based integral representation for the numerical solution of the London equations, and demonstrate the efficacy of our approach for moderate values of λL on complex three dimensional geometries. How-ever, for typical materials λL O(10−7), which makes the PDE and integral equation increasingly difficult to solve in the limit λL → 0 due to the presence of two different length scales in the problem. We derive a limiting PDE and a corresponding integral equation, and show that the solutions of this limiting PDE and integral equations are O(λL) accurate as compared to the corresponding solutions of the London equations and the Debye source integral equations respectively. We demonstrate the effective-ness of this asymptotic approach both in terms of speed and accuracy through several numerical examples.

Organizer:

Daniel Sanz-Alonso, Department of Statistics (CAMI), sanzalonso@uchicago.edu
CAM Colloquium URL: https://cam.uchicago.edu/events/cam-colloquium/

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