

# Thin Shell Model of a Coated Conductor with a Ferromagnetic Substrate

Thursday 4 May 2023 14:00 (30 minutes)

Coated conductors with magnetic substrates are thin multilayer structures; their high aspect ratio and non-linear material properties present significant difficulties for numerical simulation. Using the high width-to-thickness ratio of coated conductors we derive an integral formulation for a new model [1] based on an infinitely thin approximation for the superconducting layer and a quasistatic thin shell approximation for the magnetic substrate. Our model describes electromagnetic response of a coated conductor with a magnetic substrate and is much simpler than the existing models. A single dimensionless parameter characterizes the substrate having a finite magnetic permeability and a finite thickness. An accurate and efficient Chebyshev spectral method is derived for numerical solution. The influence of a magnetic substrate on the superconducting current and AC losses is investigated. In the limiting case our model solution tends to the known analytical solution [2]. As an example, we consider the superconducting dynamo magnetic pump, a perspective device for contactless charging the HTS magnets, and show that with a ferromagnetic substrate of the stator strip the dynamo produces a higher voltage output.

[1] L. Prigozhin and V. Sokolovsky (2023) Thin shell model of a coated conductor with a ferromagnetic substrate, preprint, 2022, <https://www.math.bgu.ac.il/~leonid/ThinShell.pdf>

[2] Y. Mawatari (2008) Physical Review B, 77104505.

**Primary authors:** PRIGOZHIN, Leonid (Ben-Gurion University); Prof. SOKOLOVSKY, Vladimir (Physics Department, Ben-Gurion University of the Negev)

**Presenter:** PRIGOZHIN, Leonid (Ben-Gurion University)

**Session Classification:** Electro-magnetic modelling - 2