An Electric-Circuit Model on the Inter-Tape Contact Resistance and Current Sharing for REBCO Cable and Magnet Applications

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Introduction

REBCO wire has multiple potential applications:
• COR08 wires for high-field accelerator magnets
• TSTC for fusion and power transmission
• REBCO pancake coils and layer wound coils
• NHMFL 32 T user magnet
• NMR and MRI

Challenges
• Difficult to protect REBCO magnets against quench
• Unavoidable critical current and n-value variations along the tape length

Contact resistance Rc in REBCO tapes plays a key role
• Low contact resistance allows current sharing
• High contact resistance causes excessive generation of Eddy currents

Driving questions
• Can we use a simple circuit model to provide important insight on the impact of Rc in REBCO cables?
• What is the optimal Rc for REBCO cables?
• What is the impact of having Ic and n-value variations on the performance of different REBCO cable configurations?

Validation of the model

We reproduced the results published by Takayasu et al. for a TSTC in self field at 77 K.

Model

Electric-circuit model based on Ngspice to study the impact of contact resistance on stacked-tape cable.

Measurements in 2-stacked tapes

Impact of Rc in a 2-tape cable with local defect:
• Insulation with Kapton tape for high Rc
• Solder Pb58Sn42 for low Rc

Monte Carlo simulations

Varying tape Ic

Varying tape n

References