Modelling and measurement of AC loss in a superconducting transformer

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AC loss in superconducting windings:
- Reduces efficiency
- Increases cost of cooling system
- Reduces thermal stability

IS YOUR TRANSFORMER DESIGN FEASIBLE?

Modeling required

Roebel cable in LV winding

Numerical model

Minimum Magnetic Energy Variation

Assumptions:
- EJL related
- Transactions of magnetization
- Application of volts

- [Iijima, ISIS22, 2013]

- [M. D. Glasson, M. Staines et al. 2009 SuST]

- [M. D. Glasson, M. Staines et al. 2012 SuST]

- [M. D. Glasson, M. Staines et al. 2013 IEEE TAS]

- [25 015006]

- [2013]

Roebel cable contains:
- 3 groups of strands:
- 3 low Ic
- 7 mid Ic
- 4 high Ic

Strands Ic of most typical strands (mid Ic sample #1)
- Present low anisotropy
- Strands Ic (B, \( \mu \))

Air-core transformer for testing (1 phase)

Tape requirements for transformer feasibility

**CONCLUSION**

Model agrees with measurements of 1 MVA transformer

40 MVA transformer will have efficiency better than conventional transformers

Critical current required to surpass efficiency of conventional transformers is achievable