THE JOSEPHSON IMPEDANCE BRIDGE AT SP

Gunnar Eklund, Tobias Bergsten and Karl-Erik Rydler
SP Technical Research Institute of Sweden
Box 857, SE-501 15 Borås, Sweden

Introduction

The Josephson impedance bridge (JIB) is based on two programmable Josephson voltage standards (PJVS) with 1 V PTB arrays producing ac voltages applied to two impedance standards under comparison, the idea was first reported in [1]. The bridge is used below 400 Hz (a few kHz at 1:1 ratio).

Disadvantage:
Increasing uncertainty with frequency due to the transitions.

Advantages compared to an inductive voltage divider bridge:
Better uncertainty at a sufficiently low frequency.
Simple automation.
Maintained accuracy at arbitrary ratio and phase.

Frequency dependence method (FDM)

The FDM assumes a linear frequency dependence of the bridge error due to the Josephson voltage transitions.

The bridge balances for a capacitance ratio measurement:
1. < 400 Hz - Main balance, unknown ratio to be determined
2. ≥1000 Hz → Determination of the bridge ratio correction
3. ≥2000 Hz → Determination of the lead inductance corr.

The FDM is dependent on the known ratio at the frequencies in balance 2 and 3. The determined corrections and correction uncertainties scale down to the main frequency. Total (balance 1) expanded uncertainty (B), 1:10 ratio at 100 Hz, = 0.3 µF/F.

Reference and publications


SP and PTB/SP publications from the AIMQuTE projekt:

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