A Novel Power Line to Reduce the Magnetic Field of Supply Currents in Josephson Digital Circuits

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Abstract — One of the important issues facing the operation of large-scale Josephson digital circuits is that the dc supply currents are large and produce magnetic fields that have adverse effects. In this study, we have evaluated a novel patterning scheme for a superconductive twisted-pair bias supply line, which can reduce the static magnetic fields which adversely affect Josephson digital circuits. Several circuits have been designed and tested to evaluate the effectiveness of the twisted-pair bias supply lines, using the 2.5 kA/cm^2 SRL standard niobium process. Our experimental results indicate that the twisted-pair bias supply line can reduce substantially the static magnetic fields generated by the bias current. And it is demonstrated that the bias margin of large-scale Josephson circuits can be improved by using the novel bias supply lines. We believe that use of the twisted-pair will contribute, along with other techniques such as burying the bias lines under a thick ground plane, to the solution for the bias-current induced dc magnetic fields.

Index Terms—Bias current, Josephson junction, Single flux quantum circuit, Static magnetic fields

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