Calculation of the Field Distributions of Superconducting Strips by Conformal Mapping

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We present magnetic-field and current distributions in superconducting strips calculated by using the conformal mapping technique. The thickness of the superconducting strips (i.e., tapes or films) is much smaller than the width, and the strips are infinitely long along the z axis. The field distributions in the xy plane are described by the complex fields $\mathcal{H}(\zeta) = H_y(x, y) + iH_x(x, y)$ that are analytic functions of $\zeta = x + iy$, and the expressions of $\mathcal{H}(\zeta)$ are derived from the conformal mapping.

We consider superconducting strips exposed to a uniform applied magnetic field H_0 and/or a transport current I_0, where H_0 and I_0 are fixed after slow increase from zero. When superconducting strips are exposed to H_0 that is smaller than the penetration field H_s, the strips are in the ideal Meissner state and the magnetic flux does not penetrate into the stirps. For $H_0 > H_s$, on the other hand, the magnetic flux penetrates into the strips: the magnetic flux stays near the center of the ideal superconducting strips without bulk pinning, or the magnetic flux penetrates only near the superconducting strips with bulk pinning. We show field distributions for various arrangements of multiple superconducting strips; i.e., coplanar strips, stacked strips, radially arranged strips, etc.