Table 34.4
MEASURED VALUES OF THE RATIO[a]
$[(c_s - c_n)/c_n]_{T_c}$

ELEMENT	$\left[\frac{c_s - c_n}{c_n}\right]_{T_c}$ $= \frac{\Delta c}{c_n}\Big/_{T_c}$
Al	1.4
Cd	1.4
Ga	1.4
Hg	2.4
In	1.7
La (HCP)	1.5
Nb	1.9
Pb	2.7
Sn	1.6
Ta	1.6
Tl	1.5
V	1.5
Zn	1.3

[a] The simple BCS prediction is $[(c_s - c_n)/c_n]_{T_c} = 1.43$.

Source: R. Mersevey and B. B. Schwartz, *Superconductivity*, R. D. Parks, ed., Dekker, New York, 1969.

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which is nothing but the London equation (34.7), with n_s given by

$$n_s = \frac{mc}{e^2} K_0. \tag{34.27}$$

Since the London equation implies the Meissner effect, it follows that in normal metals the constant K_0 must vanish. To demonstrate that BCS theory implies the Meissner effect, one calculates the kernel $K(\mathbf{r})$ by perturbation theory in the applied field, and verifies explicitly that $K_0 \neq 0$.

The actual demonstration that $K_0 \neq 0$ is a fairly complex application of BCS theory. However, a more intuitive explanation for the London equation was offered at the time the equation was first put forth, by the Londons. This explanation can be made somewhat more compelling through a phenomenological theory of V. L. Ginzburg and L. D. Landau,[55] which, though proposed seven years prior to the BCS effects created by the finite length of the cylinder in our calculations, the field distribution including these effects is shown in the figure for completeness. It should be noted that we can envision the final distribution as a superposition of the applied magnetic field and that created by the induced surface current. Such a picture is analogous to that we developed for the ohmic sphere in Section 2.4.

Example 3.2.3: Many times the geometry of a problem is *multiply connected.* A simple working definition of this term is that an otherwise solid body contains one or more holes in it. Figure 3.5 shows the bulk superconducting cylinder of Example 3.2.2 with a hole of radius a drilled out of it. Consistent with our bulk superconductor approximation, the difference between the two radii is much greater than λ. As before, we place the object in a static magnetic field and ask for the final field distributions neglecting any end effects.

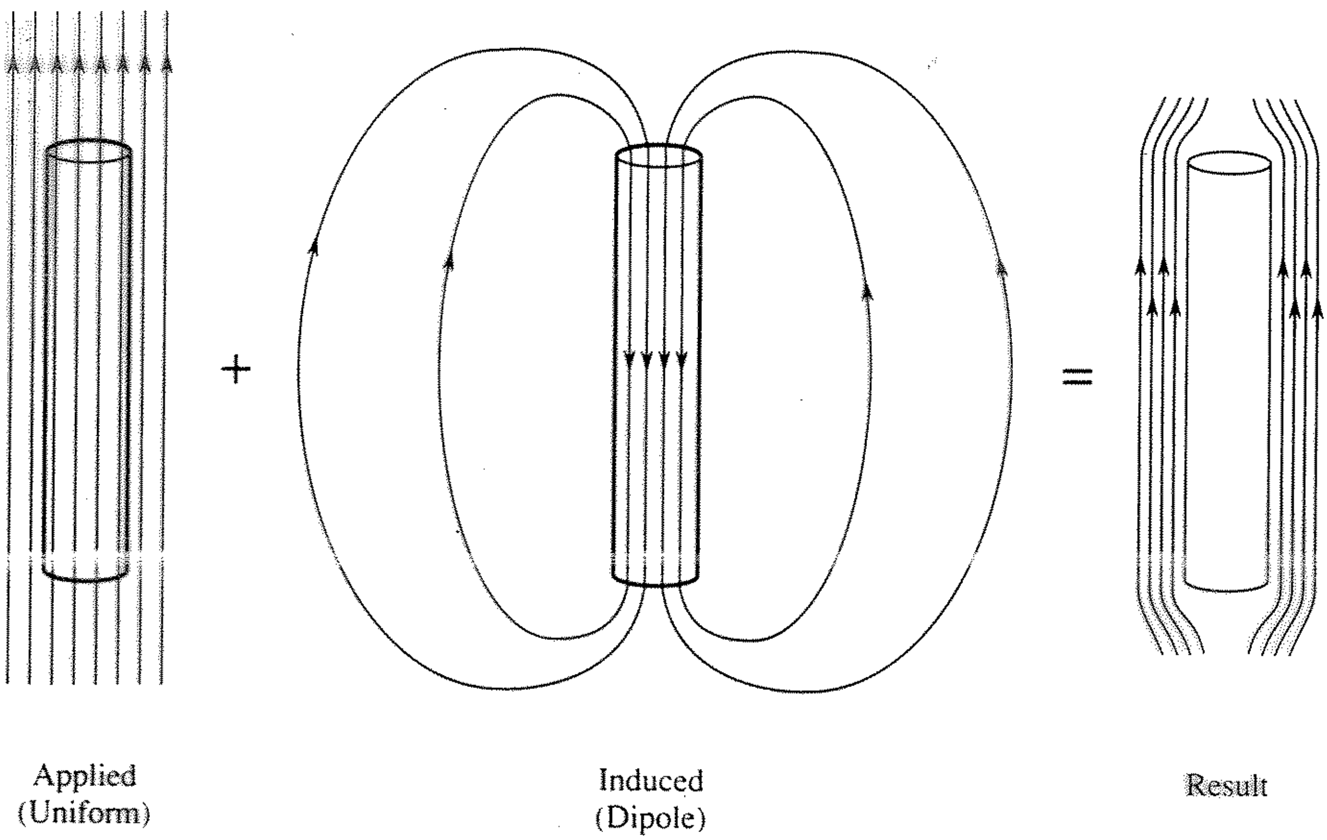

Figure 3.4 The field distribution of a long superconducting cylinder in an applied field.

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