7.29 A rectangular copper block is 30 cm in height (along z). In response to a wave incident upon the block from above, a current is induced in the block in the positive x-direction. Determine the ratio of the ac resistance of the block to its dc resistance at 1 kHz. The relevant properties of copper are given in Appendix B.

Solution:

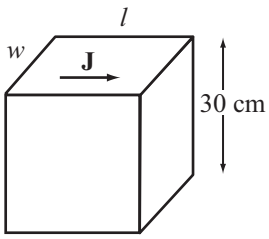

Figure P7.29 Copper block of Problem 7.29.

$$\text{d-c resistance } R_{\text{dc}} = \frac{l}{\sigma A} = \frac{l}{0.3\,\sigma w},$$

$$\text{a-c resistance } R_{\text{ac}} = \frac{l}{\sigma w \delta_s}.$$

$$\frac{R_{\text{ac}}}{R_{\text{dc}}} = \frac{0.3}{\delta_s} = 0.3\sqrt{\pi f \mu \sigma} = 0.3[\pi \times 10^3 \times 4\pi \times 10^{-7} \times 5.8 \times 10^7]^{1/2} = 143.55.$$