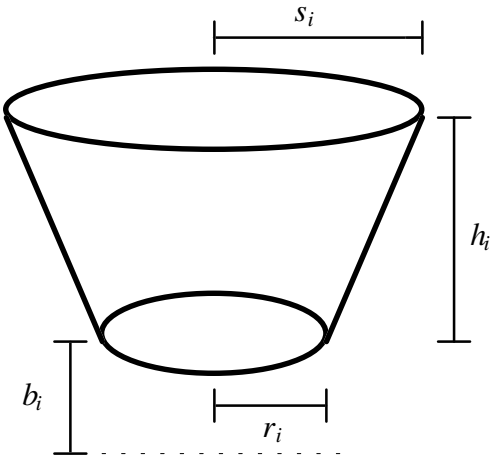
Mutual inductance between two conical coils



The mutual inductance between two concentrical coils, with dimensions as shown above and n_1 and n_2 turns can be calculated by solving the integral below. The currents are assumed to be filamental. The two coils are described by the parameters obtained with i=1 and i=2, and the obtained expressions are substututed in the equation for M.

$$g_i = \frac{s_i - r_i}{2\pi n_i}$$

$$a_i = \frac{h_i}{2\pi n_i}$$

$$x_i = (r_i + g_i\theta_i)\cos\theta_i$$

$$y_i = (r_i + g_i\theta_i)\sin\theta_i$$

$$z_i = a_i\theta_i + b_i$$

$$dx_i = \left[-y_i + g_i\cos\theta_i\right]d\theta_i$$

$$dy_i = \left[x_i + g_i\sin\theta_i\right]d\theta_i$$

$$dz_i = a_i d\theta_i$$

$$M_{12} = \frac{\mu_0}{4\pi}\int_0^{2\pi n_1}\int_0^{2\pi n_2}\frac{dx_1dx_2 + dy_1dy_2 + dz_1dz_2}{\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}}$$

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