Chapter 1

$$\left[\left(\frac{v}{c}\right)^2 - 1\right]U^2 = -\left(m_0c^2\right)^2 \quad \text{or} \quad U = \gamma m_0 c^2 \tag{1.44}$$

Chapter 2

$$\omega_c \equiv \frac{qB_0}{\gamma m_0} \tag{2.4}$$

Chapter 4

$$F_r \cong -\frac{qr}{2}\frac{dE_z}{dz}\bigg|_{r=0} = -\frac{qr}{2}E_0\,\mathrm{Im}\sum_{n=-\infty}^{\infty} ik_{z,n}a_n \exp\left[i(k_{z,n}z - \omega t)\right] \tag{4.76}$$

Chapter 5

$$\frac{1}{XF_x(x)}\frac{dX}{dx} = -\frac{\gamma_0 m_0}{pP}\frac{dP}{dp_x} = -\lambda_s \tag{5.7}$$

$$L^* = \frac{\alpha_{xf}}{\gamma_{xf}} = \frac{\beta_{x0}\left(\frac{\beta_{x0}}{f} + \alpha_{x0}\right)}{1 + \left(\alpha_{x0} + \frac{\beta_{x0}}{f}\right)^2}. \tag{5.74}$$

Chapter 6

$$A_z = \mathrm{Re}\sum_{n=1}^{\infty}\left[\alpha_n\rho^n + \beta_n\rho^{-n}\right]\exp(in\theta). \tag{6.3}$$

$$A_z = \begin{cases}\alpha_1\rho\cos(\theta), & \rho < a\\ \beta_1\rho^{-1}\cos(\theta), & \rho > a.\end{cases} \tag{6.4}$$

$$\vec{B} = B_0\begin{cases}\sin(\theta)\hat{\rho} + \cos(\theta)\hat{\theta}, & \rho < a\\ (a/\rho)^2\left[\sin(\theta)\hat{\rho} - \cos(\theta)\hat{\theta}\right], & \rho > a.\end{cases} \tag{6.5}$$

Chapter 7

$$T_a = \frac{2v}{\omega L_z}\sin\left(\frac{\omega L_z}{2v}\right) = \mathrm{sinc}\left(\frac{\omega L_z}{2v}\right), \tag{7.58}$$

$$Q \equiv \frac{\omega U_{EM}}{\langle P\rangle} = \frac{Z_0}{2R_s}\frac{2.405L_z}{\left(R_c + L_z\right)} \tag{7.71}$$

Chapter 8

$$\frac{1}{q(z)} = \frac{q_{\mathrm{Re}} - iq_{\mathrm{Im}}}{q_{\mathrm{Re}}^2 + q_{\mathrm{Im}}^2} = \frac{z - z_0 - i\pi n_0 w^2(z_0)/\lambda}{(z - z_0)^2 + \left(\pi n_0 w^2(z_0)/\lambda\right)^2} \tag{8.29}$$

$$\tan(\psi(z)) \equiv \frac{\mathrm{Im}(1/q)}{\mathrm{Re}(1/q)} = \frac{z}{Z_R} \tag{8.43}$$

$$P = \frac{\gamma^2 q^2 \vec{F}_\perp^2}{6\pi\epsilon_0 m_0^2 c^3} \tag{8.67}$$

$$P = \frac{\gamma^2 q^4 v^2 B^2}{6\pi\epsilon_0 m_0^2 c^3} = \frac{2}{3}\gamma^2 r_c m_0 c^3\left(\frac{qvB}{m_0 c^2}\right)^2 \tag{8.68}$$

$$\Delta U \approx -\frac{4\pi R}{3}\gamma_0^2 r_c m_0 c^2 \left(\frac{q v_0 \bar{B}}{\gamma m_0 c^2}\right)^2 \left(1 + 2\frac{\Delta U}{U_0}\right) \tag{8.72}$$

$$H = \gamma m_0 c^2 \left[1 + \frac{1}{2}\left(\frac{q}{\gamma m_0 c}\right)^2 \left\{ \begin{aligned} & A_u^2 \cos^2(k_u z) + A_r^2 \cos(k_r z - \omega_r t) + \ldots \\ & A_u A_r \left[\cos\left((k_r + k_u) z - \omega_r t\right) + \cos\left((k_r - k_u) z - \omega_r t\right)\right] \end{aligned} \right\} \right] \tag{8.83}$$

$$\langle H \rangle \approx \gamma m_0 c^2 + \frac{q^2 A_u A_r}{2\gamma m_0} \cos\left[(k_r + k_u) z - \omega_r t\right] \tag{8.84}$$

$$\tilde{H}(\psi, p_\psi) \approx \frac{\Delta p^2}{2\gamma_0^3 m_0} + \frac{q^2 A_u A_r}{2\gamma_0 m_0} \cos(k_r \psi) \tag{8.86}$$