$$R_{qeff} = Re\left(\frac{z_e z_K z_g}{Re z_F z_{rr}}\right)^2$$

$$= \frac{1}{Re}\left(\frac{z_e z_K z_g}{z_F z_{rr}}\right)^2$$

$$Q_q = \omega R_{qeff} C_q$$

$$Q_q = \omega C_q \frac{1}{Re}\left(\frac{1}{\omega C_e}\right)^2\left(\frac{1}{\omega C_K}\right)^2\left(\frac{1}{\omega C_g}\right)^2\left(\frac{2\delta x}{z_{0F}}\right)^2\left(\frac{2\delta}{z_{0}}\right)$$

$$Q_f = \omega C_f \frac{1}{Re}\left(\frac{z_e}{z_{0F}}\right)^2 = \frac{1}{z_{0F}} \frac{1}{Re}(z_e)^2$$

$$= \frac{1}{\omega C_q} \frac{1}{Re} \frac{(z_e z_K z_g)^2}{(z_F z_{rr})^2}$$

$$Q_{rr} = \omega C_{rr} \frac{1}{Re}\left(\frac{z_e}{z_F}\right)^2 z_K^2$$

$$= \frac{1}{z_{0rr}} \frac{1}{Re}\left(\frac{z_e}{z_F}\right)^2 z_K^2$$

$$\frac{1}{z_{0rr}} = Q_{rr} \frac{Re}{z_e^2} \frac{z_F^2}{z_K^2} \quad \text{ok}$$

$$\frac{1}{z_{0F}} = Q_F \frac{Re}{z_e^2}$$

$$Q_q = \omega C_q \frac{1}{Re} \frac{z_e^2 z_K^2 z_g^2}{} \; Q_f^2 \frac{Re^2}{z_e^4} \; Q_{rr}^2 \frac{Re^2 z_F^4}{z_e^4 z_K^4} \; \frac{z^4}{4}$$

$$= \omega C_q \, Re^3 \frac{1}{z_e^6} \frac{1}{z_K^2} z_g^2 z_F^4 Q_f^2 Q_{rr}^2 \frac{(\delta x)^4}{z^4}$$

z_q