$$\omega_0 \quad = \quad \sqrt{\frac{k}{m}}$$

$$\vec{F}(\text{air}) \quad = \quad -b\vec{v}$$

$$F(t) \quad = \quad F_{\max}\, e^{i\omega t}$$

$$m\frac{d^2x}{dt^2} \; + \; b\frac{dx}{dt} \; + \; kx \quad = \quad F_{\max}\, e^{i\omega t}$$

$$x(t) \quad = \quad Ae^{i(\omega t+\phi)}$$

$$\frac{dx}{dt} \quad = \quad i\omega A e^{i(\omega t+\phi)} \quad = \quad i\omega\, x(t)$$

$$\frac{d^2x}{dt^2} \quad = \quad -\omega^2 A e^{i(\omega t+\phi)} \quad = \quad -\omega^2\, x(t)$$

$$-m\omega^2 A e^{i(\omega t+\phi)} \; + \; ib\omega A e^{i(\omega t+\phi)} \; + \; kA e^{i(\omega t+\phi)} \quad = \quad F_{\max} e^{i\omega t}$$

$$-m\omega^2 A e^{i\phi} \; + \; ib\omega A e^{i\phi} \; + \; kA e^{i\phi} \quad = \quad F_{\max}$$

$$-\omega^2 A e^{i\phi} \; + \; i\frac{b\omega}{m} A e^{i\phi} \; + \; \frac{k}{m} A e^{i\phi} \quad = \quad \frac{F_{\max}}{m}$$

$$-\omega^2 A e^{i\phi} \; + \; i\frac{b\omega}{m} A e^{i\phi} \; + \; {\omega_0}^2 A e^{i\phi} \quad = \quad \frac{F_{\max}}{m}$$

$$-\omega^2 A \; + \; i\frac{b\omega}{m} A \; + \; {\omega_0}^2 A \quad = \quad \frac{F_{\max}}{m} e^{-i\phi}$$

$$-\omega^2 A \; + \; i\frac{b\omega}{m} A \; + \; {\omega_0}^2 A \quad = \quad \frac{F_{\max}}{m} \; [\cos(\phi) - i\sin(\phi)]$$

$$-\omega^2 A \; + \; {\omega_0}^2 A \quad = \quad ({\omega_0}^2 - \omega^2)A \quad = \quad \frac{F_{\max}}{m} \; \cos(\phi)$$

$$\frac{b\omega}{m} A \quad = \quad -\frac{F_{\max}}{m} \; \sin(\phi)$$

$$\cos(\phi) \quad = \quad \frac{Am(\omega_0^2 - \omega^2)}{F_{\max}}$$

$$\sin(\phi) \quad = \quad -\frac{Ab\,\omega}{F_{\max}}$$

$$F_{\max} \quad = \quad \sqrt{A^2m^2(\omega_0^2-\omega^2)^2 \;+\; A^2b^2\omega^2}$$

$$F_{\max} \quad = \quad A\sqrt{m^2(\omega_0^2-\omega^2)^2 \;+\; b^2\omega^2}$$

$$A \quad = \quad \frac{F_{\max}}{\sqrt{m^2(\omega_0^2-\omega^2)^2 \;+\; b^2\omega^2}}$$

$$A \quad = \quad \frac{F_{\max}/m}{\sqrt{(\omega_0^2-\omega^2)^2 \;+\; \frac{b^2}{m^2}\omega^2}}$$

$$\phi \quad = \quad \tan^{-1}\left(\frac{(\frac{b}{m})\,\omega}{\omega_0^2-\omega^2}\right)$$