$$D + \theta \frac{d\omega}{dt} = a I \qquad \omega(0)=0$$

$$RI + L\frac{dI}{dt} + a\omega = U \qquad I(0)=0$$

$$\boxed{\begin{aligned} &\frac{D}{p} + \theta p\bar\omega = a\bar I \\ &R\bar I + Lp\bar I + a\bar\omega = \frac{U}{p} \end{aligned}}$$

$$\rho = \frac{R}{2L}$$

$$\Omega_0 = \frac{a}{\sqrt{L\theta}}$$

$$\frac{DR}{paL\theta} + \frac{Rp\bar\omega}{aL} + \frac{\theta \cancel{p} D}{a} + \frac{p^2\bar\omega}{a} + \frac{a\bar\omega}{L\theta} = \frac{U}{pL\theta}$$

$$\bar\omega\left(2\rho p + \frac{p^2}{a} + \frac{a}{L\theta}\right) = \frac{U}{ap\Omega_0^2} - \frac{DR}{ap\,\Omega_0^2} + \frac{\theta D}{a}$$

$$\bar\omega = \frac{aU - DR - DLp}{L\theta p\left(p^2+2\rho p+\Omega_0^2\right)} =$$

$$\bar\omega = \underbrace{\frac{aU-RD}{L\theta}}_{\alpha}\,\frac{1}{p\left(p^2+2\rho p+\Omega_0^2\right)} - \underbrace{\frac{D}{\theta}}_{\beta}\,\frac{1}{p^2+2\rho p+\Omega_0^2}$$

$$\Omega^2 = \Omega_0^2 - \rho^2$$

$$\bar\omega = \frac{\alpha}{\Omega_0^2}\left[\frac{1}{p} - \frac{p+2\rho}{(p+\rho)^2+\Omega^2}\right] - \beta\,\frac{1}{(p+\rho)^2+\Omega^2}$$

$$\bar\omega = \frac{\alpha}{\Omega_0^2}\left[\frac{1}{p} - \frac{p+\rho}{(p+\rho)^2+\Omega^2} - \frac{\Omega}{(p+\rho)^2+\Omega^2}\,\frac{\rho}{\Omega}\right]$$

$$-\beta\,\frac{\Omega}{(p+\rho)^2+\Omega^2}\cdot\frac{1}{\Omega}$$

$$\omega = \frac{aU-RD}{a^2}\left\{1 - e^{-\rho t}\left[\frac{\rho}{\Omega}\sin\Omega t + \cos\Omega t\right]\right\} -$$

$$-\frac{D}{\theta\,\Omega}e^{-\rho t}\sin\Omega t$$