Darcy's Law for Inclined flow

In Darcy units : $q = -\frac{kA}{\mu}\left(\frac{dP}{ds} - \frac{\rho g}{1.0133\times10^{6}}\frac{dz}{ds}\right)$

In oilfield units : $q = -0.001127\frac{kA}{\mu B}\left(\frac{dP}{ds} - 0.433\gamma\frac{dz}{ds}\right)$

$$k\,[D] = k\,[md] \times \left[\frac{1D}{1000\,md}\right] = 10^{-3}\,k\,[md]$$

$$A\,[cm^2] = A\,[ft^2] \times \left[\frac{(30.48)^2\,cm^2}{1\,ft^2}\right] = 929.03\,A\,[ft^2]$$

$$\frac{dP}{ds}\left[\frac{atm}{cm}\right] = \frac{dP}{ds}\left[\frac{psi}{ft}\right] \times \left[\frac{1\,ft}{(30.48)\,cm}\right] \times \left[\frac{1\,atm}{14.7\,psi}\right]$$

$$= 2.23\times10^{-3}\frac{dP}{ds}\left[\frac{psi}{ft}\right]$$

$$\frac{\rho g}{1.0133\times10^{6}}\frac{dz}{ds}\left[\frac{atm}{cm}\right] = \left(\frac{32.185\times 62.428}{32.185\times 12^2}\gamma\right)\frac{dz}{ds}\left[\frac{psi}{ft}\right]$$

$$\times \left[\frac{1\,atm}{14.7\,psi}\right] \times \left[\frac{1\,ft}{30.48\,cm}\right]$$

$$= \left(2.23\times10^{-3}\right)\left(0.433\,\gamma\right)\frac{dz}{ds}\left[\frac{psi}{ft}\right]$$

$$q\left[\frac{cm^3}{s}\right] = q\left[\frac{STB}{day}\right] B\left[\frac{RB}{STB}\right] \times \left[\frac{5.615\ ft^3}{1\ RB}\right]$$

$$\times \left[\frac{(30.48)^3\ cm^3}{1\ ft^3}\right] \times \left[\frac{1\ day}{24(3600)\ s}\right]$$

$$= 1.84\, q B \left[\frac{RB}{day}\right]$$

$$q = -\frac{KA}{\mu}\left[\frac{dP}{ds} - \frac{\rho g}{1.0133 \times 10^6}\frac{dz}{ds}\right]$$

$$1.84\, qB\left[\frac{STB}{day}\right] = -\frac{10^{-3} K\,[md] \times 929.03\, A\,[ft^2]}{\mu} \times$$

$$\left[2.23 \times 10^{-3}\frac{dP}{ds}\left[\frac{psi}{ft}\right] - (2.23 \times 10^{-3})(0.433\gamma) \times \frac{dz}{ds}\left[\frac{psi}{ft}\right]\right]$$

$$\Rightarrow \quad q = -0.001127\frac{KA}{\mu B}\left[\frac{dP}{ds} - 0.433\gamma\frac{dz}{ds}\right]$$