4.1.2 van GENUCHTEN (1980) Empirical.

M. van Genuchten, Soil Science Society of America, Journal 44 (1980) 892-898.

Moisture Content

$$\theta = \theta_r + \frac{(\theta_s - \theta_r)}{\left[1 + \left(\alpha \frac{P}{\gamma_w}\right)^n\right]^m}$$

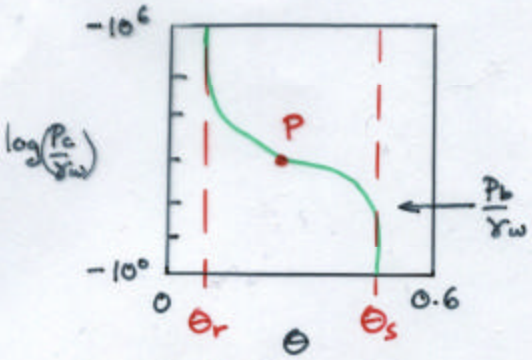
$$\theta_e = \frac{1}{\left[1 + \left(\alpha \frac{P}{\gamma_w}\right)^n\right]^m}$$

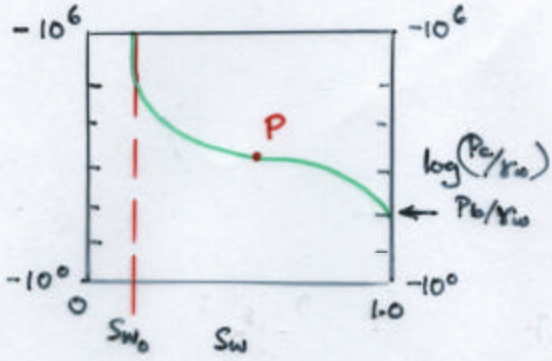
Saturation

$$S = S_{w_0} + \frac{(1 - S_{w_0})}{\left[1 + \left(\alpha \frac{P}{\gamma_w}\right)^n\right]^m}$$

$$S_e = \frac{1}{\left[1 + \left(\alpha \frac{P}{\gamma_w}\right)^n\right]^m}$$

Parameters: m, n, α





not porosity ⟶ $n = 1/(1-m)$

$$\alpha = \frac{\gamma_w}{P_b}\left(2^{1/m} - 1\right)^{(1-m)} \qquad \alpha \simeq \frac{1}{h_b} \simeq \frac{\gamma_w}{P_b}$$

DETERMINING PARAMETERS

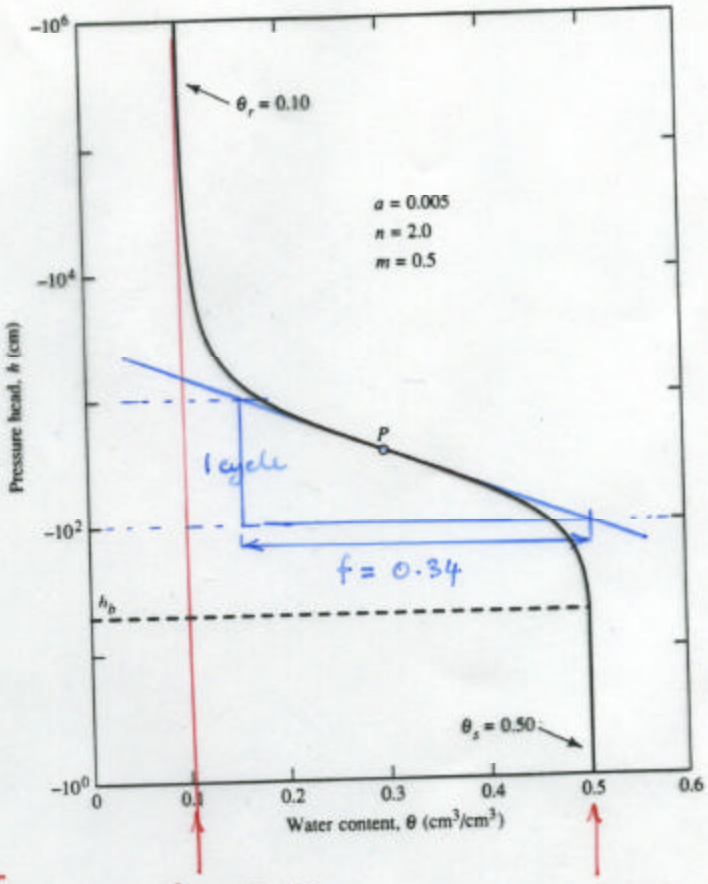
MEAN MOISTURE CONTENT

$$\theta_p = \frac{1}{2}(\theta_s + \theta_r)$$

$$= \frac{1}{2}(0.5 + 0.1) = 0.3$$

SLOPE AT θ_p

$$f = 0.34$$



$\theta_r = 0.10$ $\qquad$ $\theta_s = 0.50$

DIMENSIONLESS SLOPE

$$f_p = \frac{f}{\theta_s - \theta_r}$$

$$f_p = \frac{0.34}{0.5 - 0.1} = 0.85$$

$$m = \begin{cases} 1 - \exp(-0.8 f_p) & 0 \le f_p \le 1 \\ 1 - \dfrac{0.5755}{f_p} + \dfrac{0.1}{f_p^2} + \dfrac{0.025}{f_p^3} & f_p > 1 \end{cases}$$

$m = 0.5$

$$n = \frac{1}{1-m} = \frac{1}{1-.5} = 2$$

$$\alpha = \frac{\gamma_w}{P_b}\left(2^{1/m} - 1\right)^{1-m} = \frac{\gamma_w}{P_b}(1.73)$$

$$\alpha \simeq \frac{1}{P_b/\gamma_w}$$