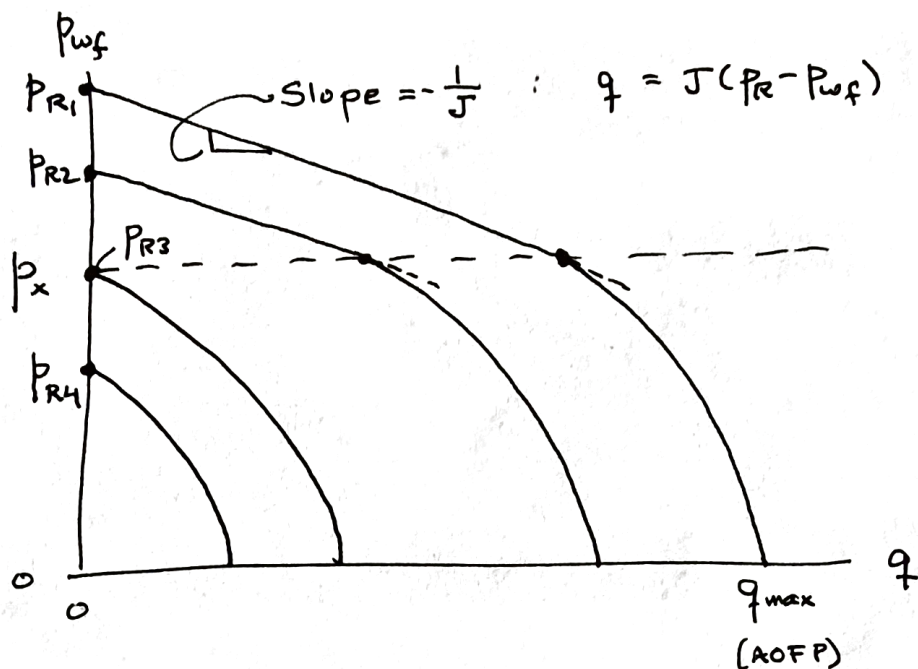




$$\underline{P_x \leq P_{wf} \leq P_R}$$

$$q = J(P_R - P_{wf}) \quad | \quad q_x = J(P_R - P_x)$$

$$\underline{0 \leq P_{wf} \leq P_x}$$

$$q = J(P_R - P_x) + J'(P_x^2 - P_{wf}^2)$$

$$\text{At } P_{wf} = P_x \quad \frac{dq}{dP_{wf}} = \underbrace{-J}_{P_{wf} > P_x} = \underbrace{-2J'P_x}_{P_{wf} \leq P_x} \Rightarrow \boxed{J' = J/(2P_x)}$$

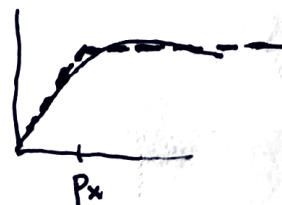
ensures continuity of $q(P_{wf})$ and dq/dP_{wf} at the $P_{wf} = P_x$ boundary.

~~Reservoir~~

Knowns: P_R, P_x, J

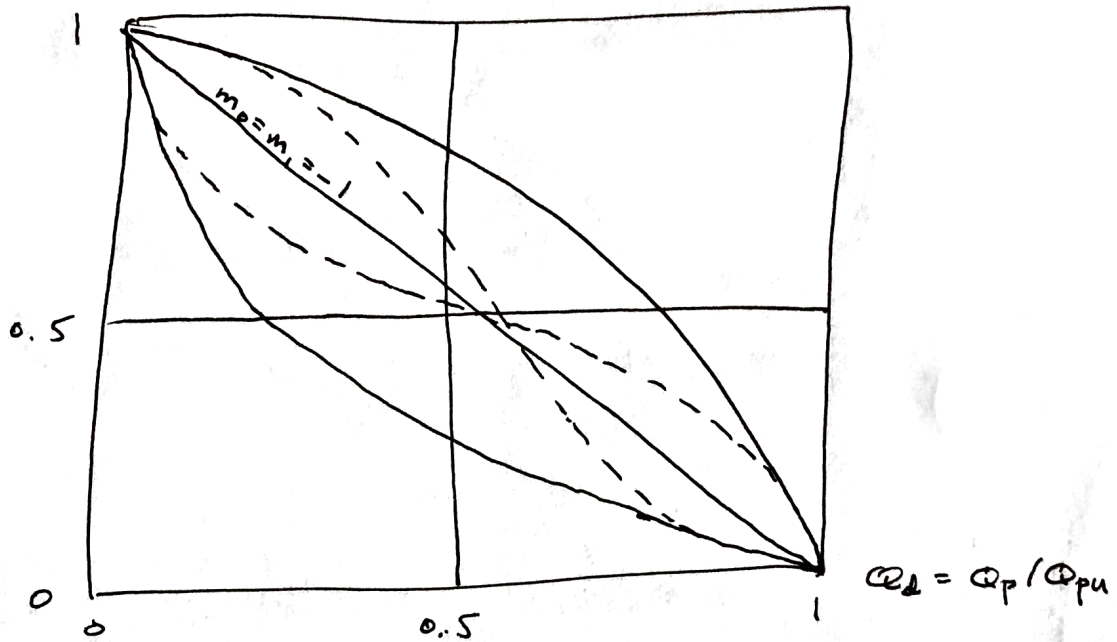
Oils: $P_x = P_b$

Gases: $P_x \sim 200 \text{ bara}$ (found by fitting $P/\mu Z$ function)



$$p_d = p_R / p_{Ri}$$

$$p_d(Q_d) \text{ Eq. ?}$$



$$m_0 = \left. \frac{dp_d}{dQ_d} \right|_{Q_d=0} \quad (1)$$

$$m_1 = \left. \frac{dp_d}{dQ_d} \right|_{Q_d=1} \quad (2)$$

Specify m_0, m_1

Constraints:

$$\text{All } Q_d : \frac{dp_d}{dQ_d} \leq 0$$

$$-1.0 < \frac{m_0}{m_1} < -0.1$$

Limits on m_0, m_1 to guarantee monotonic function, requires a "search" in $0 < Q_d < 1$.

$$p_d(Q_d=0) = 1 \quad (3)$$

$$p_d(Q_d=1) = 0 \quad (4)$$

Target:

(a) Specify $p_d(Q_d=0.5)$

(b) Specify $p_d(Q_d=0.25)$

(c) Specify $p_d(Q_d=0.75)$

Eq. Form: Cubic

$$\text{e.g. } p_d = a_0 + a_1 Q_d + a_2 Q_d^2 + a_3 Q_d^3 = p_d(Q_d)$$

General Material Balance Equation

$$\left\{ \underline{p_R} = p_{Ri} \cdot p_d(\underline{Q_p} = Q_d \cdot Q_{pu}) \right\}$$