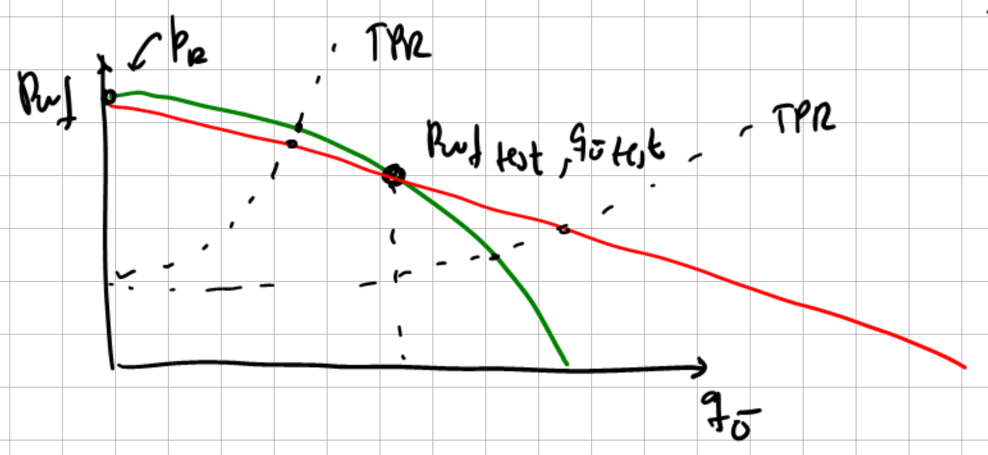
Video 12 - Additional comments on linear IPR

$q_o = J\,(p_R - p_{wf})$ ⟶ Undersaturated oil

J: geometry ⇝

fluid-properties ⟶ $(\mu_o B_o)_{@\,p_{av}}$

for gas, saturated oil using a linear IPR is not adequate !

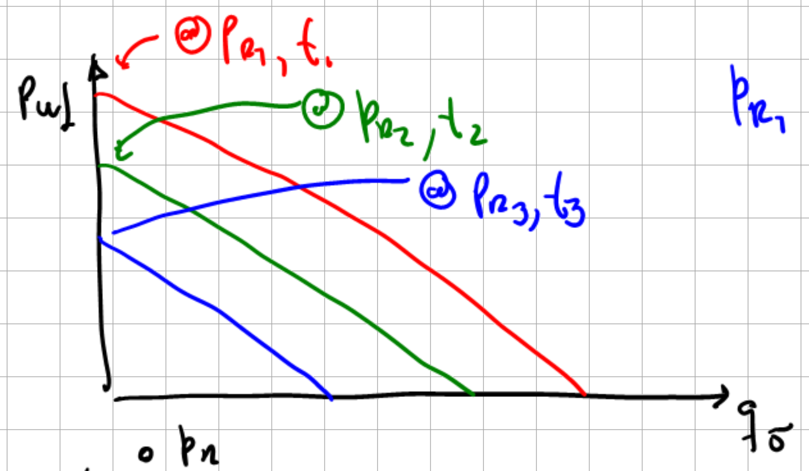


changes to IPR due to depletion

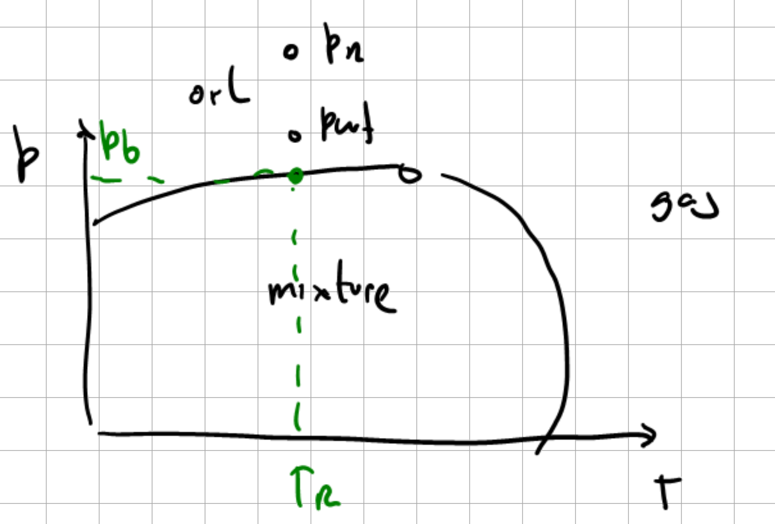
p_R ⟶ goes down

$J \sim (\mu_o B_o)_{@p_{av}}$, r_e, pss, ss, S, otherwise J remains fairly constant with time

$p_{av} = (p_R + p_{wf}) \cdot 0.5$



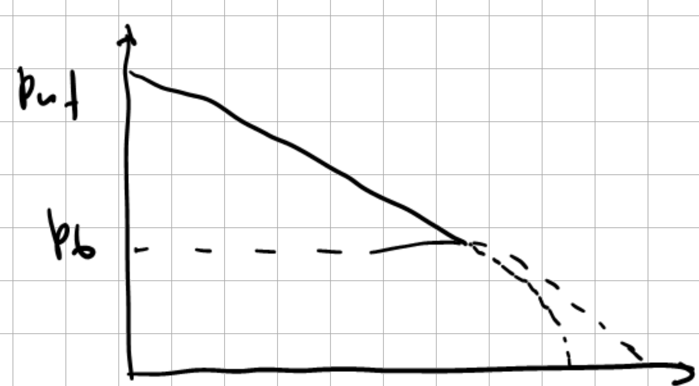
$p_{R1} > p_{R2} > p_{R3}$



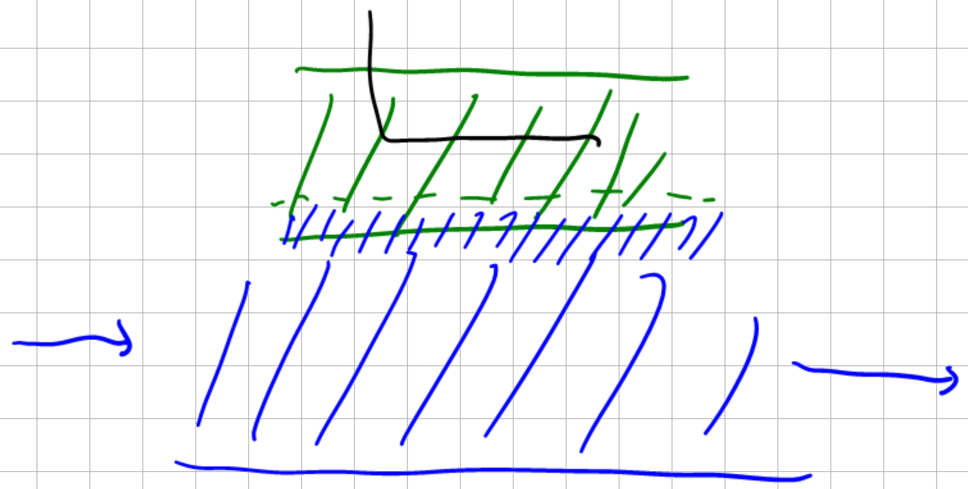
linear IPR valid if $p_{wf} > p_b$ $\quad p_R > p_b$

water injection

strong hydrodynamic aquifer



no aquifer, no injection, undersaturated oil reservoir



flow of water + oil (undersaturated) → exhibits a linear IPR

liquid

incompressible

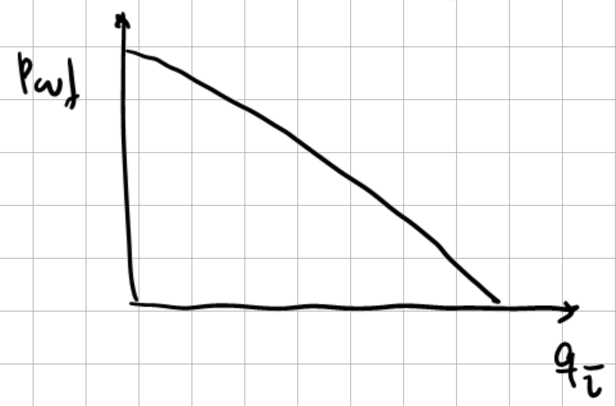
$$J_L = \frac{(q_o + q_w)}{(P_R - P_{wf})}$$

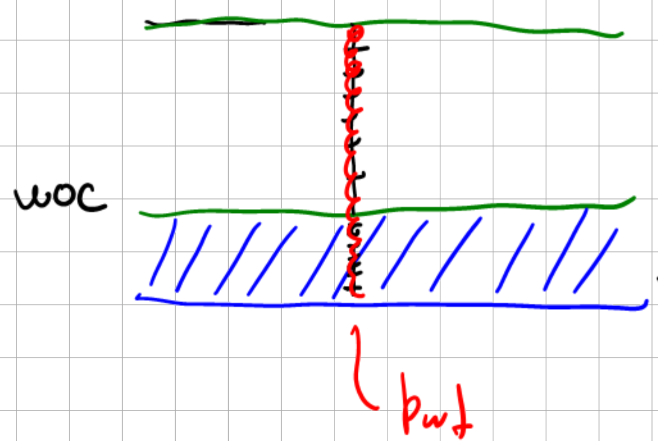
$$q_L = J_L \, (P_R - P_{wf})$$

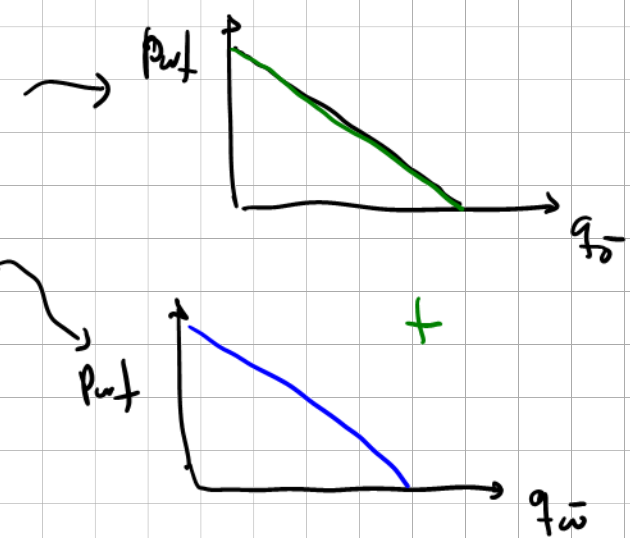
$$q_o = q_L \, (1 - w_c)$$

$$w_c = \frac{q_w}{q_o + q_w}$$

$$q_w = q_L \, (w_c)$$

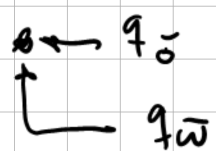


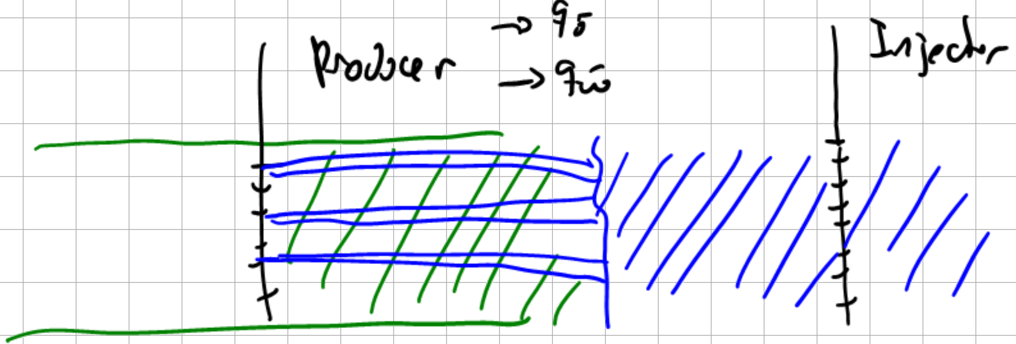


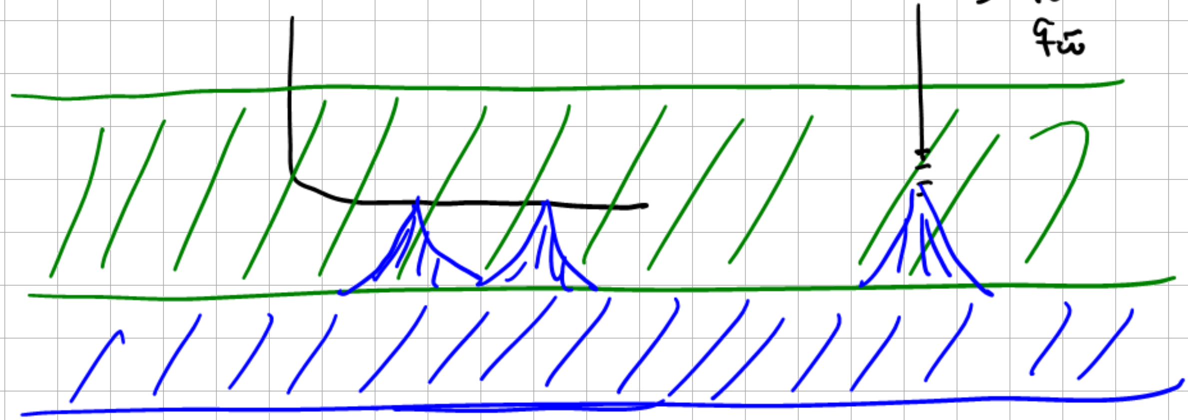


mobility $\lambda_o = \frac{k_{ro}}{\mu_o}$ $\lambda_w = \frac{k_{rw}}{\mu_w}$

$\lambda_o < \lambda_w$





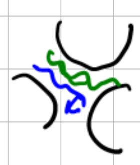


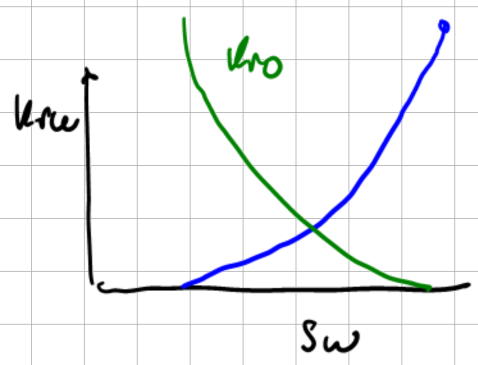
water coning - cusping

$J\ f(K)$ when two phases flowing

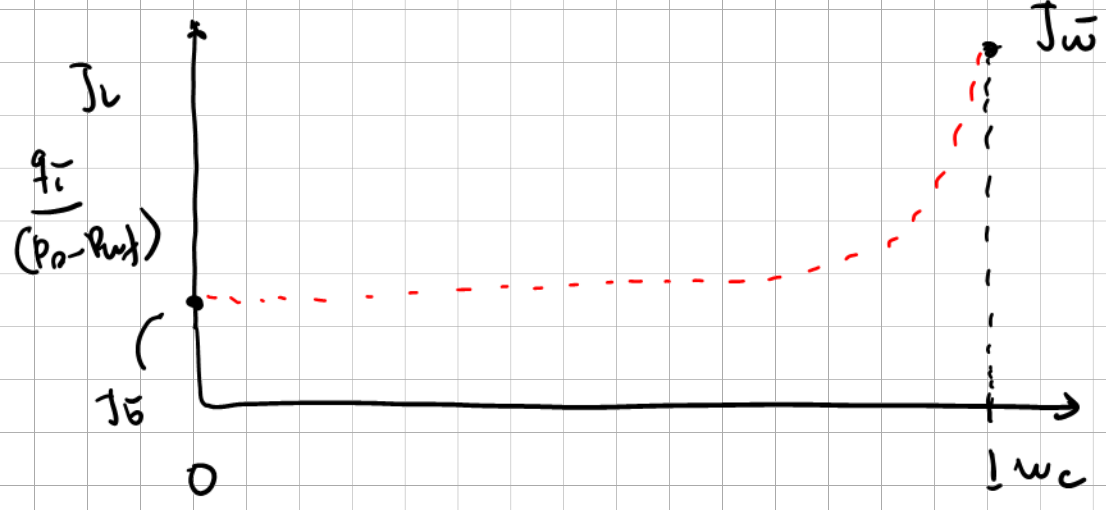
$K\ k_{ro}$

k_{rw}





$S_w = \frac{V_w}{V_T}$ in the pore



$w_c = \frac{q_w}{q_o + q_w}$

$q_L = J_L\,(p_R - P_{wf})$

$q_o = q_L \cdot (1 - w_c)$

$q_w = q_L\,(w_c)$