# Mobility-weighted fluid density

A method to average the multi-phase fluid density depending on relative phase mobilities:

$$\rho(p,T) = \frac{M_{rw}\rho_w + M_{ro}(1+R_{sn})\rho_o + M_{rg}(1+R_{vn})\rho_g}{M_{rw} + M_{ro}(1+R_{sn}) + M_{rg}(1+R_{vn})}$$

where

| | | |
|---|---|---|
| (1) | $\rho_w(p,T),\ \rho_o(p,T),\ \rho_g(p,T)$ | water density, oil density and gas density as functions of reservoir pressure $p$ and temperature $T$ |
| (2) | $M_{rw}(s,p,T),\ M_{ro}(s,p,T),\ M_{rg}(s,p,T)$ | relative phase mobilities as functions of reservoir saturation $s(\mathbf{r})$ at reservoir location $\mathbf{r}$ and reservoir pressure $p$ and temperature $T$ |
| (3) | $R_{sn}(p,T),\ R_{vn}(p,T)$ | normalized cross-phase exchange ratios as functions of reservoir pressure $p$ and temperature $T$ |

This concept gives more weight to phases with higher relative phase mobilities.

This normally finds application in multi-phase pressure diffusion where more agile phase contributes more to average phase pressure variation.