Buckley–Leverett @model

@wikipedia

Ideally balanced water + dead oil 1D waterflood model without gravity and capillary effects.

(1) $\frac{\partial s}{\partial t} + \frac{q}{\phi \Sigma} \cdot \frac{\partial f}{\partial x} = 0$	(2) $s(t=0,x)=0$	(3) $s(t,0)=1$

where

$s = E_D = \frac{s_w - s_{wi}}{1 - s_{wi} - s_{or}}$	water oil displacement efficiency
q	sandface injection rate, assumed equal to sandface liquid production rate
$\phi(x)$	reservoir porosity
$\Sigma(x) = h\,D$	cross-section area available for flow
$h(x)$	reservoir thickness
$D(x)$	reservoir width = reservoir length transversal to flow
$f = \frac{1}{1 + M_{ro}/M_{rw}}$	in-situ fractional flow function
$M_{ro} = k_{ro}(s_o)/\mu_o$	relative oil mobility
$M_{wo} = k_{rw}(s_w)/\mu_w$	relative water mobility

Approximations

In many practical applications (for example, laboratory SCAL tests and reservoir proxy-modeling) one can assume constant porosity and reservoir width:

(4) $\frac{\partial s}{\partial t_D} + \frac{\partial f}{\partial x_D} = 0$	(5) $s(t=0,x)=0$	(6) $s(t,0)=1$

where

$t_D = \frac{q\,t}{V_\phi}$	dimensionless time
$x_D = \frac{x}{L}$	dimensionless distance between injector and producer
L	reservoir length along x-axis
$V_{\phi m} = (1 - s_{wi} - s_{orw}) \cdot \phi \cdot h \cdot D \cdot L$	mobile reservoir pore volume

See Also

Petroleum Industry / Upstream / Subsurface E&P Disciplines / Dynamic Flow Model / Reservoir Flow Model (RFM)

[Production / Subsurface Production / Reserves Depletion / Recovery Methods]