Oil+Water RPM Corey @model

OIL		WATER	
(1)	$k_{row}(s_o) = k_{rowc} \cdot \left[\frac{s_o - s_{orw}}{1 - s_{wl} - s_{orw}} \right]^{n_{ow}}$	(2)	$k_{rwo}(s_w) = k_{rwoc} \cdot \left[\frac{s_w - s_{wco}}{1 - s_{wco} - s_{orw}} \right]^{n_{wo}}$
s_o	current oil saturation, $s_o = 1 - s_w$	s_w	current water saturation, $s_w = 1 - s_o$
s_{orw}	residual oil saturation to water displacement, below which oil is immobile	s_{wco}	critical water saturation to oil displacement, below which water is immobile
k_{rowc}	maximum oil relative permeability to water displacement	k_{rwoc}	maximum water relative permeability to oil displacement
n_{ow}	oil relative permeability curvature to water displacement	n_{wo}	water relative permeability curvature to oil displacement

where s_{wl} is connate water saturation which maybe

- equal to critical s_{wco}

or

- less than critical $s_{wl} < s_{wco}$ like for example in petroleogenetic rocks.

This model assumes no free gas presence in pores.

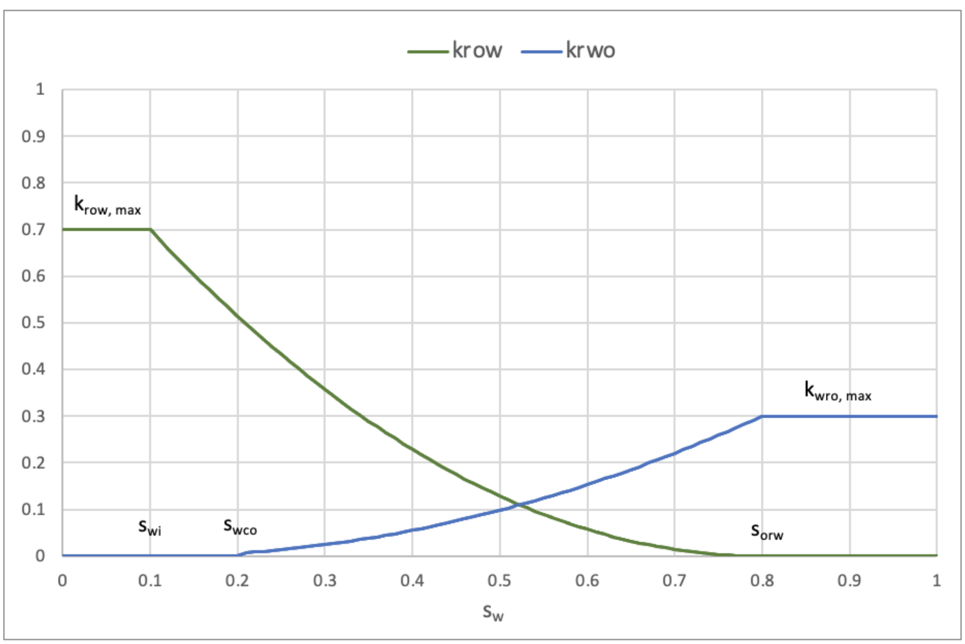

Fig. 1. Typical Oil+Water RPM Corey @model

The alternative form of the Oil+Water RPM Corey @model can be presented as a function of normalized water saturation s :

(3) $$s = \frac{s_w - s_{wi}}{1 - s_{wl} - s_{orw}}$$

which changes between $s = 0$ for initial water saturation $s_w = s_{wl}$ and $s = 1$ for maximum water saturation $s_w = 1 - s_{orw}$.

In this case equations (1) and (2) take form:

OIL	WATER
(4) $k_{row}(s_o) = k_{rowc} \cdot (1-s)^{n_{ow}}$	(5) $k_{rwo}(s_w) = k^*_{rwoc} \cdot (s - s^*)^{n_{wo}}$
	(6) $s^* = \frac{s_{wco} - s_{wi}}{1 - s_{wl} - s_{orw}}$
	(7) $k^*_{rwoc} = k_{rwoc} \cdot \left(\frac{1 - s_{wl} - s_{orw}}{1 - s_{wco} - s_{orw}} \right)^{n_{wo}}$

and fractional flow function is going to be:

(8) $$f_w = \frac{M_{rwo}}{M_{rwo} + M_{row}} = \frac{(s-s^*)^{n_{wo}}}{(s-s^*)^{n_{wo}} + g \cdot (1-s)^{n_{ow}}}$$

(9) $$\dot{f}_w = \frac{df_w}{ds} = g \cdot (s-s^*)^{n_{wo}-1} \cdot \frac{n_{wo}(1-s)^{n_{ow}} + n_{ow}(s-s^*)(1-s)^{n_{ow}-1}}{[(s-s^*)^{n_{wo}} + g \cdot (1-s)^{n_{ow}}]^2}$$

where

(10) $$g = \frac{M_{rowc}}{M_{rwoc}} \cdot \left(\frac{1 - s_{wco} - s_{orw}}{1 - s_{wl} - s_{orw}} \right)^{n_{wo}}$$

See also

Petroleum Industry / Upstream / Subsurface E&P Disciplines / Petrophysics / Relative Permeability / RPM @model

[Permeability] [Absolute permeability]