Dual-component Cozeny-Karman permeability @model

(1) $$k = 1014.24 \cdot FZI^2 \cdot \frac{\phi^3}{(1-\phi)^2}$$

where

ϕ	effective porosity
FZI	Flow Zone Indicator

with Flow Zone Indicator having a complex dependance on porosity and shaliness:

(2) $$FZI(V_{sh}, \phi_r) = \mathrm{w}_1(V_{sh})\, \phi_r^{m_1} + \mathrm{w}_2(V_{sh})\, \phi_r^{m_2}$$

for each lithofacies individually.

Usually, the first component $\mathrm{w}_1(V_{sh})\, \phi_r^{m_1}$ dictates Flow Zone Indicator values at low porosities while second component $\mathrm{w}_2(V_{sh})\, \phi_r^{m_2}$ takes over at high porosities.

This allows to cover a wider range of porosity variations comparing to single-component Cozeny-Karman permeability @model.

The dependance of weight coefficients on shaliness can be often approximated as:

(3) $$\mathrm{w}_1(V_{sh}) = \mathrm{w}_{01}\, (1 - V_{sh}/V_{sh1})^{g_1}$$
(4) $$\mathrm{w}_2(V_{sh}) = \mathrm{w}_{02}\, (1 - V_{sh}/V_{sh2})^{g_2}$$

where

$\{\mathrm{w}_{01}, \mathrm{w}_{02}\}$	the highest values of weights for shale-free rock matrix
$\{V_{sh1}, V_{sh2}\}$	critical values of shaliness at which the corresponding component of Flow Zone Indicator vanishes
$\{g_1, g_2\}$	cementing factors, when low they diminish dependance on shaliness

This model is very flexible and covers a wide range of practical cases.

When $\{m_1, m_2\}$ and $\{g_1, g_2\}$ are small (~ 0) the Flow Zone Indicator becomes independent on porosity and shaliness and the model degrades to conventional Cozeny-Karman permeability @model with $FZI = \mathrm{const}$.

See also

Petroleum Industry / Upstream / Subsurface E&P Disciplines / Petrophysics / Absolute permeability / Absolute permeability @model