AD FALCON API Manual

Brooks–Corey Permeability Model

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1 Brooks–Corey Permeability Model

1.1 Syntax

```
@Perm: BrooksCorey lambda <lambda> k_sat <k_sat> [e_ref <e_ref>]
@Perm: BrooksCoreyKe lambda <lambda> k_sat <k_sat> [ke_ref <e_ref>] [k_min
<k_min>]
```

In the Brooks–Corey model, the relative permeability for water is expressed using a power law in terms of the effective saturation, S_e. It is given by:

$$k_{rw} = S_e^{\frac{2+3\lambda}{\lambda}} \tag{1}$$

where λ is a model parameter controlling the sensitivity of the permeability to saturation changes. For gas, the relative permeability is expressed as:

$$k_{rg} = (1 - S_e)^2 \left[1 - (1 - S_e)^{\frac{2+\lambda}{\lambda}}\right] \tag{2}$$

As in the Van Genuchten model, a void ratio correction factor is applied if needed:

$$k_c = \frac{e^3(1 + e_{ref})^2}{e_{ref}^3(1 + e)^2} \tag{3}$$

yielding:

$$k_{rw}^{eff} = \max\{k_{rw} \times k_c,\ k_{min}\} \tag{4}$$

$$k_{rg}^{eff} = \max\{k_{rg} \times k_c,\ k_{min}\} \tag{5}$$

Equation (1) uses the Brooks-Corey effective-saturation law (Brooks and Corey, 1964), while the relative-permeability closure follows the usual Burdine-type form used with Brooks-Corey curves (Burdine, 1953). Equation (3) uses a Kozeny-Carman-type void-ratio multiplier.

1.2 References

- Brooks, R. H., & Corey, A. T. (1964). *Hydraulic properties of porous media and their relation to drainage design*. Transactions of the ASAE, 7(1), 26-28.
- Burdine, N. T. (1953). *Relative permeability calculations from pore-size distribution data*. Journal of Petroleum Technology, 5(3), 71-78.
- Carman, P. C. (1937). *Fluid flow through granular beds*. Transactions of the Institution of Chemical Engineers, 15, 150-166.