



AD FALCON API Manual

Fredlund & Xing SWRC Model

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1 Fredlund & Xing SWRC Model

1.1 Syntax

Specify this model in % Materials using @SWRC::

```
@SWRC: FredlundXing Pb <Pb> nx <nx> mx <mx> omega_prime <omega_prime> SW_max
<SW_max> SW_min <SW_min>
```

1.1.1 Parameters

Input keyword	Symbol	Meaning
Pb	P_b	Air-entry value (pressure).
nx	n_x	Shape parameter controlling slope.
mx	m_x	Shape parameter controlling slope.
omega_prime	Ω'	Void-ratio influence in modified suction $p_c^* = p_c e^{\Omega'}$.
SW_max	S_{r-max}	Maximum degree of saturation.
SW_min	S_{r-min}	Minimum degree of saturation.

Modified Fredlund and Xing model

To account for the effects of volume changes on the soil water retention curve (SWRC), we define a modified suction,

$$p_c^* = p_c e^{\Omega'} \quad (1)$$

where

- Ω' is a material parameter reflecting the influence of the void ratio.
- p_c is suction.
- e is the void ratio.

By neglecting hydraulic hysteresis and utilizing the modified suction, the SWRC can be generalized from the formulation developed by Fredlund and Xing (1994). This generalized

SWCC is given by:

$$S_w = S_{rmin} + (S_{r-max} - S_{r-min}) \left(\ln \left[\exp(1) + \left(\frac{p_c^*}{P_b} \right)^{n_x} \right] \right)^{-m_x} \quad (2)$$

In this equation, S_w is the degree of saturation, P_b denotes the air-entry value, while n_x and m_x are model parameters that control the slope of the SWCC. Furthermore, S_{r-max} and S_{r-min} represent the maximum and minimum values of the degree of saturation, respectively.

Equation (2) is a modified form of the Fredlund-Xing SWRC (Fredlund and Xing, 1994), with FALCON using the additional modified-suction term to account for void-ratio effects.

1.2 References

- Fredlund, D. G., & Xing, A. (1994). *Equations for the soil-water characteristic curve*. Canadian Geotechnical Journal, 31(4), 521-532. <https://doi.org/10.1139/t94-061>

