MAT_SOIL_SANISAND

This is Material Type 207. SANISAND is a family of Simple ANIsotropic SAND constitutive models within the frameworks of critical state soil mechanics and bounding surface plasticity (Dafalias and Manzari, 2004; Dafalias *et al.,* 2004; Taiebat and Dafalias 2008). The model renders the slope of the dilatancy stress ratio (also known as the phase transformation line) such that at the critical state the dilatancy stress ratio coincides with the critical state failure stress ratio. The bounding surface formulation enables cyclic loading response simulation. The model accounts for the inherent anisotropy effects, as well as the effect of fabric changes during the dilatant phase of deformation on the subsequent contractant response upon load increment reversals. By using the concept of limiting compression curve and a proper closed yield surface, the model predicts the plastic strains during any type of constant stress-ratio loading, which is important at high confining pressures causing grain crushing.

Card Format

Card 1	1	2	3	4	5	6	7	8
Variable	MID	RO	G0	K0	PREF	RHOC	THETA	X
Type	I	F	F	F	F	F	F	F
Default	none	none	none	none	none	0.37	none	none

Card 2	1	2	3	4	5	6	7	8
Variable	EIN	ALPHAC	EA	LAMBDA	XI	NB	H0	CH
Type	F	F	F	F	F	F	F	F
Default	none	none	none	none	0.7	none	none	none

Card 3	1	2	3	4	5	6	7	8
Variable	P0	CC	ND	A0				
Type	F	F	F	F				
Default	none	0.778	none	none				

Card 4	1	2	3	4	5	6	7	8
Variable	ANISO	KH	ZMAX	CZ				
Type	F	F	F	F				
Default	0.333	1.0	none	none				

Card 5	1	2	3	4	5	6	7	8
Variable	PAT	M	N	V				
Type	F	F	F	F				
Default	101325.0	0.05	20.0	1000.0				

VARIABLE	DESCRIPTION
MID	Material identification. A unique number has to be chosen.
RO	Mass density.
G0	Material constant in shear modulus as a function of pressure and void ratio.
K0	Material constant in bulk modulus as a function of pressure and void ratio.
PREF	Reference pressure in Limiting Compression Curve, associated with unity void ratio
RHOC	Exponent in Limiting Compression Curve, ρ_c
THETA	Exponent in transitional compression behaviour, θ
X	Material constant X
EIN	Initial void ratio
ALPHAC	Critical surface parameter, α^c_c
EA	Material constant in Critical State Line, E_A or E_0 (for no inherent fabric anisotropy, i.e., statistically isotropic particle's orientation)
LAMBDA	Material constant in Critical State Line, λ
XI	Material constant in Critical State Line, ξ
NB	Bounding surface parameter, n^b
H0	Kinematic hardening parameter, h_0
CH	Kinematic hardening parameter, c_h
P0	Yield surface parameter, p_0
CC	Yield surface parameter, c
ND	Dilatancy surface parameter, n^d
A0	Dilatancy parameter, A_0 or A_d (for no fabric change effect)
ANISO	Inherent fabric anisotropy measure, a. $a = 0$ corresponds to a fabric formation where particles lie entirely on the global XY bedding plane. $a = 1$ implies a fabric formation where particles are oriented parallel to the vertical global Z direction. $a = 1/3$ indicate a statistically isotropic particle's orientation. It is expected that the most common cases will be in the range of $0<a<1/3$, i.e., with a preference toward horizontal orientations.

KH	Material constant, k_h, in dependence of hardening parameters on inherent fabric anisotropy
ZMAX	Material constant for fabric change effect, z_{max}
CZ	Material constant for fabric change effect, c_{z}
PAT	Atmospheric pressure
M	Yield surface constant, m
N	Yield surface constant, n
V	Flow rule constant, V

Remarks:

References

Dafalias,Y. F., Manzari, M.T. (2004). “Simple plasticity sand model accounting for fabric change effects.” *Journal of Engineering Mechanics,* 130(6), 622–634.

Dafalias, Y. F., Papadimitriou, A. G., and Li, X. S. (2004). “Sand plasticity model accounting for inherent fabric anisotropy.” *Journal of Engineering Mechanics,*130(11), 1319–1333.

Taiebat M., Dafalias, Y. F. (2008). “SANISAND: simple anisotropic sand plasticity model.” International Journal for Numerical and Analytical Methods in Geomechanics, 32(8), 915–948.