Advanced soil models. Multilaminate (ML) (extended version)

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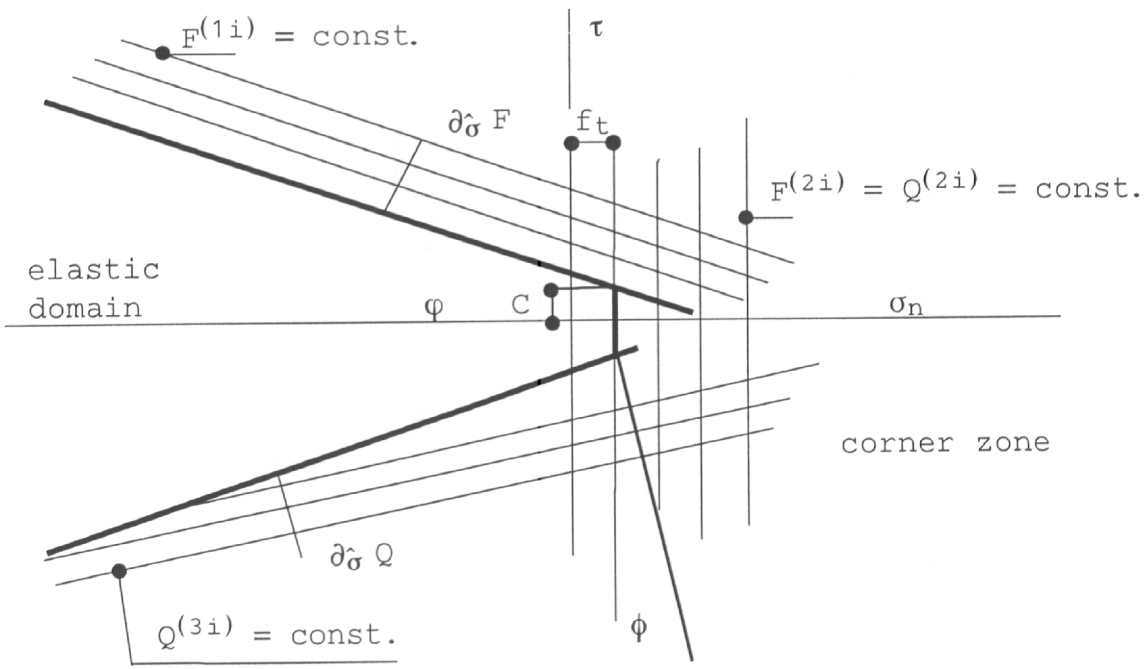
ML: Assumptions

Assumptions:

- Failure may occur in the matrix material which is modeled with aid of elasto-plastic models derived from Menetrey-Willam criterion (Hoek-Brown, M-C, D-P)
- Failure may occur also along weakness planes
- Maximum 3 weakness planes can be set up



ML: Menetrey-Willam criterion

$$F(\xi,\rho,\theta) = (A_f\rho)^2 + m_f\left[B_f\ \rho\ r_f(\theta,e) + C_f\ \xi\right] - D_f = 0$$

$$\xi = \frac{1}{\sqrt{3}}I_1 \quad 3\theta = \frac{3\sqrt{3}}{2}J_3 J_2^{-\frac{3}{2}} \quad \rho = \sqrt{2J_2}$$

Generalized criterion	A	B	C	m	e
Huber-Misès	0	$\sqrt{\frac{3}{2}}\frac{1}{f_c}$	0	1	1
Drucker-Prager	0	$\sqrt{\frac{3}{8}}\frac{f_c+f_t}{f_c f_t}$	$\frac{3}{2}\frac{f_c-f_t}{f_c f_t}$	1	1
Rankine	0	$\frac{1}{\sqrt{6}f_t}$	$\frac{1}{\sqrt{3}f_t}$	1	$\frac{1}{2}$
Mohr-Coulomb (smooth)	0	$\frac{1}{\sqrt{6}}\frac{f_c+2f_t}{f_c f_t}$	$\frac{1}{\sqrt{3}}\frac{f_c-f_t}{f_c f_t}$	1	$\frac{f_c+2f_t}{2f_c+f_t}$
Hoek-Brown (smooth)	$\frac{\sqrt{1.5}}{f_c}$	$\frac{1}{\sqrt{6}f_c}$	$\frac{1}{\sqrt{3}f_c}$	$3\frac{f_c^2-f_t^2}{f_c f_t}\frac{e}{e+1}$	e

where ξ,ρ,θ are Haigh-Westergaard stress coordinates equal to:

$$\xi = \frac{1}{\sqrt{3}}I_1 \qquad (1)$$