List of Symbols

1.1. Symbols

A is the normal section of the pile [m²]

Acc_i is the acceleration of the node i [m/s²]

c is the wave propagation velocity [m/s]

C_H is the damping factor of the Lysmer analogue [Ns/m]

C_p is the internal damping factor of the pile (0.5) [-]

c_u is the undrained cohesion [MPa]

$\Delta displ_i$ is the increment of displacement of the node i [m]

$displ_i$ is the displacement of the node i [m]

D is the embedded pile length or the soil layer thickness [m]

D(p) is the normalized average gap between the measured and calculated quantities [-]

dz is an infinitesimal thickness of pile [m]

E_p is the elastic modulus of the pile material [MPa]

E_2/E_1 is the ratio of elastic soil moduli during loading and unloading [-]

E' is the modulus of viscosity of the soil [$Pa.s^{-1}$]

E_i is the initial modulus of elasticity of the soil [MPa]

F_1 and F_2 are the rheologic parameters of the Bea's theory [-]

$F_{result,\,i}$ is the resulting force at the node i [MN]

$F_{int,\,i}$ is the internal forces applied at the node i [MN]

$F_{ext,\,i}$ is the external forces applied at the node i [MN]

f_s is the local shear strength measured with the CPT [MPa]

g is the local tangent shear modulus of the soil[MPa]

G_i is the initial shear modulus of the soil [MPa]

G is the gravity acceleration [9,81 m/s²]

G_2/G_1 is the ratio of shear moduli during loading and unloading [-]

h is the dropping height [m]

h_i is the height of the pile element [m]

Δh is the increase of cylinder's thickness per unit of distance in the Cyl model [m]

I the nominal impedance of the pile [MN.s/m]

J is the damping factor expressing the loading rate influence [s/m^N]

J_c is the CASE damping constant [-]

J_b is the base damping factor [s/m]

J_s is the viscous or soil damping factor [$s/m^{0.2}$]

J is the rheologic damping factor [$s/m^{0.2}$]

J_R is the Rausche damping factor [s/m^N]

J_S is the Smith standard damping [s/m]

K_l is the coefficient of soil viscosity of the Dayal & Allen's theory [-]

K_H is the spring stiffness of the Lysmer analogue[N/m]

$k_{el,i}$ is the elementary stiffness of two consecutive pile elements [MN/m]

$K_{0,1}$ is the modified Bessel function of the second kind of order 0 and 1 respectively. [-]

L is the pile length [m]

$Mass_i$ is the mass of the pile element i [kg]

M_m is the ram mass [kg]

n is the viscous exponent of the Briaud's theory [-]

N is the exponent expressing the non-linear dependency of the loading rate influence [-]

N_{el} is the radial discretization (the number of rings in the Cyl model) [-]

P_v is the vertical exciting force [MN]

p is the vector of parameters to be optimised

$\mathbf{p}^0$ is the initial set of values for **p**

Δp_i is the variation of the parameter p_i [unit of p_i]

q is the soil quake [m]

q_c the cone resistance measured with the CPT [MPa]

Q_u is the static ultimate pile capacity [MN]

Q_b and Q_s are the base and shaft capacities [MN]

Q_c is the creep Resistance [MN]

Q_{stat} is the static soil reaction [MN]

Q_{rheol} is the rheologic soil reaction [MN]

R_a is the maximum static reacxtion mobilized prior the time under consideration [MN]

R_s is the static soil reaction mobilized at the time of consideration [N]

R_f is the ratio of friction and cone resistance from the CPT [-]

R_p the pile radius [m]

R_{rheol} is the rheologic soil reaction [MN]

$R_{rheol,,ult}$ is the ultimate rheologic soil resistance [MN]

$R_{stat,ult}$ is the ultimate static soil resistance [MN]

R_m is the radius of influence from Randolph and Wroth' theory [m]

r_b is the pile base radius [m]

Δr is the thickness of each cylinder in the Cyl model [m]

s is the pile settlement [m]

ΔS is the settlement of the cone of soil [m]

S_H is the settlement of the half-space medium beneath the base [m]

S_{ui} is the undrained shear strength [MPa]

$t = \frac{L}{c}$ is the travel time of the wave into the pile [s]

T_i is the inter-ring reaction between elements i and i-1 in the Cyl model [MN]

u_p, v_p are the pile displacement and velocity [m, m/s]

u_s, v_s are the soil displacement and velocity [m, m/s]

v is the pile velocity [m/s]

Vel_i is the velocity of the node i [m/s]

V_o initial velocity of the harmonic loading [m/s]

v_i is the impact velocity [m/s]

v_p is the pile material wave velocity [m/s]

v_x is the maximum velocity achieved up prior the time under consideration [m/s]

V_p and V_s are the compressive and shear wave velocities [m/s]

V_0 is the initial velocity [m/s]

z_i is the depth of the bottom of the i° soil layer [m]

1.2. Greek symbols

α is the coefficient of dispersion of Holeyman (2000) [-].

α and β are the rheologic parameters of the Randolph approach [MPa; -]

β is the rate of increase in shearing resistance per log cycle of increase in strain [-];

β is the soil material damping ratio.

γ is the angular distortion or shear strain [-].

γ_r is the reference shear strain [-];

Δt is the time increment [s];

ε is the axial strain [-];

$\dot{\varepsilon}$ is the strain rate [s^{-1}];

η is the mobilization ratio [-];

η_c : falling efficiency [-];

η_i : impact efficiency [-];

η_p is the mobilization ratio at pile shaft [-];

λ is the loading rate in the Bea's theory [$\%.h^{-1}$];

υ is the Poisson's ratio [-].

ξ is the attenuation coefficient [rad^{-1}]

ρ is the volumetric mass of the soil [kg/m]

ρ_p the volumetric mass of the pile material [kg/m^3];

σ the normal stress [MPa];

σ_{stat} is the static axial strength of the soil [MPa];

σ_{rheol} is the rheologic axial strength of the soil [MPa];

σ_{max} is the maximum static axial static stress reached during the test [MPa]

$\sigma_{stat,ult}$ is the ultimate static axial strength of the soil [MPa];

$\sigma_{rheol,ult}$ is the ultimate rheologic axial strength of the soil [MPa];

τ the shear stress [MPa];

τ_{stat} is the static shear stress [MPa];

τ_{visq} the viscous shear stress [MPa];

τ_{rheol} is the rheologic shear stress [MPa];

τ_p the shear stress mobilized at the pile shaft [MPa].

τ_{max} is the maximum static shear stress reached during the test [MPa]

$\tau_{stat,ult}$ is the ultimate static shear strength of the soil [MPa];

$\tau_{rheol,ult}$ is the ultimate rheologic shear strength of the soil [MPa];

$w(a_0,r)$ is the displacement amplitude at a distance r and of dimensionless frequency a_0;

ω is the circular frequency [rad/s];