"HYDROELASTIC EXCITATION OF CYLINDERS"

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CONTENTS

LIST OF FIGURES

Page No.

NOTATION

a	lateral spacing of vortex trail
a_l	moment lever arm
A	projected area of body on plane normal to body movement
A_c	calibration coefficient
A_L	linearizer constant
B_c	calibration constant
B_L	linearizer constant
B_i $i=1,7$	constant
c	damping coefficient of cylinder
c_f	damping factor
c_w	damping coefficient of near wake
C	radial distance from cylinder centre to external vortex
C_D	drag force coefficient
C_F	lift coefficient perpendicular to free stream
C_{FO}	lift coefficient perpendicular to free stream for $\alpha = 0$
C_L	lift force coefficient
C_S	skin friction drag coefficient
C_T	transverse force coefficient
$C_{Fy}(f)$	cospectral function
d	half length of near wake
D	diameter of cylinder
exp	exponential function
E	elastic modulus

E_w	work
f_d	driving frequency
f_n	fundamental natural frequency
f_{on}	fundamental natural frequency in vacuua
f_r	frequency ratio
f_s	frequency of vortex shedding
f_{wc}	wake coupling constant
f'_{wc}	dimensionless wake coupling constant
F	resultant force
F_{Bi} i=2,4	buffetting forces
F_{Dy}	transverse component of instantaneous drag force
F_{MVS}	maximum force due to vortex shedding
F_R	total force acting on pier
F_{VS}	vortex shedding force
F_W	wake force
F_x	force component in streamwise direction
F_y	force component in transverse direction
$F(z)$	complex potential function
F_1	velocity component of wake force
F_2	displacement component of wake force
F_3	velocity component of drag force
F_4	displacement component of drag force
g	acceleration due to gravity = 32.2 fps^2

$G_{Fy}(f)$		cross spectral function
$\|G_{Fy}(f)\|$		modulus of cross spectral function
h		longitudinal spacing of vortex street, width of near wake
i	=	$\sqrt{-1}$ imaginary quantity
i_c	=	current
I		moment of inertia
I_w		moment of inertia of near wake
k		mechanical spring constant
k_1		a constant
k_w		angular spring constant of near wake
K		virtual mass coefficient
K_1		a constant
K_L		linearizer constant
K_α		a factor relating velocity ratio and circulation
l		point along length of a structure
L		length of structure
L_*		modified length of structure
m		mass of structure
m_1		mass of structure per unit length
m_L		linearizer exponent
M		number of piles in road
M_B		bluffness ratio
M_x		moment of body at point x on its length

n	an integer
n_L	linearizer exponent constant
N	number of rows of piles
p	pressure
p_f	in phase force coefficient
P	force
P_i $i=1,2$	constant
q	resultant velocity
q_f	quadrature force coefficient
Q	quadrature force
$Q_{Fy}(f)$	quadspectral function
R	constant
Re	Reynolds Number
R_f	resistance of film
R_w	resistance of film at fluid temperature
s	constant
S	Strouhal number
S^*	Roshko's wake Strouhal number
S_i $i=1,2$	material stresses
t	time
t_{1i}	time for vortex to travel from point 1 to point i
t_s	period of vortex shedding
T	torque

u	velocity in streamwise direction
U_s	free stream line velocity
U_∞	upstream velocity
v	velocity in transverse direction
V_c	critical flow speed
V_r	reduced velocity
V_R	resultant velocity
V_{out}	output voltage from anemometer
V_{LIN}	output voltage from linearizer
V_s	speed of vortex
w	complex velocity
x	streamwise or horizontal coordinate axis
y	transverse or vertical coordinate axis
Y	amplitude of oscillation
Y_o	half amplitude of oscillation
Y_{STAT}	half amplitude of oscillation due to static loading
z	complex number
Z	reduced amplitude (Y/D)
Z_o	reduced half amplitude (Y_o/D)
Z_s	section modulus
α	wake angle
α_e	effective wake angle
α_{eM}	value of effective wake angle at mid amplitude

α_M	maximum value of wake angle
α_{MO}	maximum value of angle of approach of relative velocity
α_o	angle of approach of relative velocity
$\bar{\alpha}$	maximum wake angle with respect to centre of gravity of wake
β	velocity ratio
Γ	circulation
δ_a	fluid dynamic logarithmic decrement
δ_s	logarithmic damping decrement of structure
δ_i i=1,2	phase angles
Δ	deflection of structure
ε	percentage of flow energy in vortex
ε_i i=1,2	phase angle
θ	phase angle between force and displacement
κ	vortex strength
λ_i i=1,4	roots of characteristic equations
μ	dynamic viscosity
ν	kinematic viscosity
π	3.1416
ρ	density of fluid
ϕ	phase angle
ψ	stream function
ω	vorticity function
ω_n	fundamental angular frequency of structure
ω_v	angular frequency of wake or vortex shedding