List of Symbols

Symbols	Descriptions
A	Cross sectional area of the Shaft in m^2
c	Viscous Damping coefficient of the shaft Ns/m
c_b	Damping coefficient of bearing in Ns/m
E	Modulus of elasticity N/m^2
e	Strain along shaft axis in m
e_v	Eccentricity of the shaft in y direction in m
e_w	Eccentricity of the shaft in z direction in m
F_x	Rubbing force in Y direction
f_x	Non dimensional Rubbing force in Y direction
F_y	Rubbing force in Y direction
f_y	Non dimensional Rubbing force in Y direction
h	Thickness if the disk in m
$I1$	Polar mass moment of inertia $kg\text{-}m^2$
$I2$	Diametrical mass moment of inertia $kg\text{-}m^2$
I_A	Area moment of inertia in mm^4
K_l	Linear stiffness coefficient of a bearings in N/m
K_{nl}	Nonlinear bearing stiffness coefficient in N/m^3
K_r	Stiffness of rub surface
L,	Length of the shaft in m
L_d	Disk location from one of the ends of the shaft in m
m	Mass of the shaft in kg
M	Mass of the disk in kg
m_u	Unbalance Mass in kg
N	Number of discs
N_b	Linear forward natural frequency
N_{bn}	Non-linear forward natural frequency
N_f	Linear forward natural frequency
N_{fn}	Non-linear forward natural frequency
P_o	Static axial force in N
P_1	Pulsating axial force in N
r_1	Eccentricity of the unbalance mass in m
R_d	Radius of the disk in m
R_s	Radius of the shaft in m
u, v, w	Displacements in x, y and z directions
Z_a, W_b	Amplitude of base excitation
ψ, ϑ and θ	Angular displacement about the axes of Z, Y, and X
θ_1	Non dimensional disk mass

β_2	Non dimensional unbalance mass
δ	Loss Factor or Clearance between rotor and stator
Δx	Eccentricity of stator axis with rotor in Y direction
Δy	Eccentricity of stator axis with rotor in Z direction
η	Coefficient of friction
λ	Eigen value of mode shape function
ρ	Mass Density of the shaft in kg/m^3
σ	Detuning parameter
Ω	Rotating speed/ Excitation frequency in rad/s
Ω_1	Frequency of an axial force excitation in rad/s
ω_1	Forward Natural frequency in rad/s
Ω_2	Spinning speed of the rotor in rad/s
ω_2	Backward Natural frequency in rad/s
ω_e, Ω_b	Base excitation frequency