Notation

$\boldsymbol{M}_v, \boldsymbol{K}_v, \boldsymbol{C}_v$	Mass, stiffness and damping matrices of the vehicle
$\boldsymbol{X}_v, \dot{\boldsymbol{X}}_v, \ddot{\boldsymbol{X}}_v$	Displacement, velocity and acceleration vectors of the vehicle
$\boldsymbol{F}_{vt}$	Load vector acting on the vehicle
$\boldsymbol{F}_{vt}^s$	Load vector acting on the vehicle running on straight track
$\boldsymbol{F}_c^s$	Sub-load vector acting on car body on straight track
$\boldsymbol{F}_{t_i}^s (i = 1\sim2)$	Sub-load vector acting on frames 1~2 on straight track
$\boldsymbol{F}_{w_i}^s (i = 1\sim4)$	Sub-load vector acting on wheelsets 1~4 on straight track
$\boldsymbol{F}_{vt}^c$	Load vector acting on vehicle caused by geometry parameters of curved track
$\boldsymbol{F}_c^c$	Sub-load vector acting on the car body caused by geometry parameters of curved track
$\boldsymbol{F}_{t_i}^c (i = 1\sim2)$	Sub-load vector acting on frames 1~2 caused by geometry parameters of curved track
$\boldsymbol{F}_{w_i}^c (i = 1\sim4)$	Sub-load vector acting on wheelsets 1~4 caused by geometry parameters of curved track
$\boldsymbol{M}_t, \boldsymbol{K}_t, \boldsymbol{C}_t$	Mass, stiffness and damping matrices of the track
$\boldsymbol{X}_t, \dot{\boldsymbol{X}}_t, \ddot{\boldsymbol{X}}_t$	Displacement, velocity and acceleration vectors of the track
$\boldsymbol{F}_{tv}$	Load vector acting on the track
$\boldsymbol{F}_r^L, \boldsymbol{F}_r^R, \boldsymbol{F}_s$	Sub-load vectors acting on the left rail, right rail and sleeper
$\boldsymbol{a}_n$	Prediction coefficient vector
$\overline{\boldsymbol{F}}_n$	Past forces vector
$\boldsymbol{C}$	Covariance matrix
$\widetilde{\boldsymbol{C}}$	Approximated covariance matrix by KL expansion

$\boldsymbol{\Lambda}, \boldsymbol{\Phi}$	Eigenvalue and eigenvectors matrices
x, y, z	Longitudinal, Lateral, vertical components along absolute coordinate system
$\alpha = L, R$	Left and right side of the vehicle or track
$F_{ix}^{\alpha}, F_{iy}^{\alpha}, F_{iz}^{\alpha}$	Longitudinal, lateral and vertical forces acting on the ith wheelset
$r_{w_i}^{\alpha}$	Instant rolling radius of the wheels of the ith wheelset
d_0	Half of the lateral distance between wheel-rail nominal contact points
m_0	Vehicle mass
ψ_{w_i}	Yaw angle of the ith wheelset
g	Gravity acceleration
V	Running speed
m_c	Car body mass
r_0	Wheel nominal radius
h_{tw}	Height of frame's centre of gravity (COG) above wheelset's COG
h_{bt}	Height of secondary suspension centre above frame's COG
h_{cb}	Height of car body's COG above secondary suspension centre
R_c	Curvature radius of the track at the location of car body's COG
I_{cx}, I_{cz}	Roll and yaw moments of inertia of car body
I_{tx}, I_{tz}	Roll and yaw moments of inertia of frame
R_{ti}	Curvature radius of the track at the location of the ith frame's COG
$\phi_{sec}, \ddot{\phi}_{sec}$	Superelevation angle and its second derivative at the location of car body's COG
$\phi_{seti}, \ddot{\phi}_{seti}$	Superelevation angle and its second derivative at the location of the ith frame's COG
m_w	Wheelset mass
I_{wx}, I_{w_y}, I_{w_z}	Roll, pitch and yaw moment of inertia of wheelset
ϕ_{sewi}, $\dot{\phi}_{sewi}$,	Superelevation angle and its first derivative, second derivative at the location of the

$\ddot{\phi}_{sewi}$	ith wheelset's COG
R_{wi}	Curvature radius of the track at the location of the ith wheelset's COG
$\dot{\beta}_{wi}$	Angular velocity of the ith wheelset in pitch direction
k_{px}, k_{py}, k_{pz}	Longitudinal, lateral, vertical stiffness of primary suspension
c_{px}, c_{py}, c_{pz}	Longitudinal, lateral, vertical damping coefficients of primary suspension
k_{sx}, k_{sy}, k_{sz}	Longitudinal, lateral, vertical stiffness of secondary suspension
c_{sx}, c_{sy}, c_{sz}	Longitudinal, lateral, vertical damping coefficients of secondary suspension
d_w	Half of the lateral distance between primary suspensions
d_s	Half of the lateral distance between secondary suspensions
l_t	Half of wheelbase
l_c	Half of the distance between bogie centres
Y_k, Z_k, Φ_k	kth mode shape functions of rail's lateral, vertical bending and torsion
N_w	Number of wheelsets
x_{w_i}	Longitudinal coordinate of the ith wheelset
K	Number of modes considered for the rail beam
$M_{w_i}^{\alpha}$	Equivalent moment acting on rails from the ith wheelset
P	Prediction order
$a_{n-\vartheta}$	Prediction coefficient
f_{wr}	Wheel-rail coefficient of friction
λ_n , $\boldsymbol{\phi}_n$	Eigenvalues and normalized eigenvectors of covariance matrix
C_0	Variance of the random field of wheel or rail profiles
x_i, x_j	Coordinates of two discrete points of wheel or rail profiles
l	Correlation length
e_r	Relative error

b	Limit value
m	Number of levels of SS
N	Number of samples at each level of SS
P_F	Failure probability
P_j	Conditional failure probability
p_0	Level probability
N_T	Total number of samples
W	Ride index
f	Vibration frequency in Hz
Δt	Time step
S	Travel distance
η	Distribution parameter, such as mean value or variance
$\bar{\eta}$	Value of distribution parameter where partial derivative is evaluated
e_η	Normalized sensitivity