LIST OF SYMBOLS AND NOTATIONS

α	The effect of elasticity
β	The hysteretic shape parameter
δ	Portion of error correction weight adjustment for w_j that is due to an error at output unit O_i also, the information about their error at unit O that is propagated back to the hidden units that feed into unit O
δ_h	Portion of error correction weight adjustment for u_{ih} that is due to the backpropagation of error information from the output layer to the hidden unit Z_h
δ_j	Portion of error correction weight adjustment for v_{hj} that is due to the backpropagation of error information from the output layer to the hidden unit K_j
ε	Hysteretic energy dissipation
γ	The hysteretic shape parameter
$\eta(\varepsilon)$	The stiffness degradation parameter
λ	Pinching parameter
μ	Learning rate
v_{hj}	Weight from hidden unit Z_h to hidden unit Kj
$v_{hj,n}$	Update weight unit hj
$v_{hj,o}$	Old weight unit hj
v_{oj}	Bias on hidden unit j
ψ_0	Pinching parameter
Θ	Performance Index
A	Slope of CJ hysteretic model
A_{g1}	First generated KT seismic record
A_{g2}	Second generated KT seismic record
A_g	Ground Acceleration Record
ANN	Functional form of ANN
c	Y axis-interception
c	Damping
$\boldsymbol{c}$	Damping matrix
d	Constant parameter control pinching behavior
D	The accumulated plastic deformation of the CJ hysteretic element
D_o	Damage at time step t_0
e	Residual between target and output
E	Error Criterion / Objective Function
$ETOL$	Energy tolerance
$f(x)$	Activation Function
f_{ANN}	Predicting Restoring / Spring Force by ANNs
f_c	Damping Force
f_s	Spring Force
f_R	Restoring Force
$\boldsymbol{f}_{ANN}$	Predicting Restoring / Spring Force vector
$\boldsymbol{f}_s$	Spring force vector
$g(t)$	A temporal modulation function
h	Index number of hidden layer 1 neuron
$H(x)$	Unit step function

i	Index number of input neuron
j	Index number of hidden layer 2 neuron
k	K-iteration of implicit time integration
k_1	Linear stiffness
k_2	Nonlinear stiffness
k_j	Output value unit K_j
k_in_j	Summation value of weight input signal unit j
K_j	Hidden unit j
l	Number of training data set
m	Slope of linear equation
m	Mass
$\boldsymbol{m}$	Mass matrix
n	Number of input neuron
n_u	Numbers of time steps of displacement
n_v	Numbers of time steps of velocity
n_f	Numbers of time steps of restoring / spring force
o	Resulting output value computing by ANNs
o_in	Summation value of weight input signal output unit
O	Output Neuron
p	Number of neuron in hidden layer 2
P_{ext}	External Force
q	Number of neuron in hidden layer 1
r	EBWBN hysteretic parameter
$RTOL$	Force tolerance
s	A parameter controlling the rate of initial drop in slope
$SREE$	Sum Square Relative Error
t	Time step t
t	Target value
Δt	Increment time step Δt
u	Displacement
$\dot{u}$	Velocity
$\ddot{u}$	Acceleration
u_o	Displacement at time step t_0
$\dot{u}_o$	Velocity at time step t_0
$\ddot{u}_o$	Acceleration at time step t_0
u_{oh}	Bias on hidden unit h
u_{ih}	Weight from input unit y_i to hidden unit Z_h
$u_{ih,n}$	Update weight unit ih
$u_{ih,o}$	Old weight unit ih
u_{ih}^*, v_{hj}^*, w_j*	The optimal weights that derived from training procedure
Δu_{ih}	Weight adjustment value from input unit y_i to hidden unit Z_h
$v(\varepsilon)$	The strength degradation parameter
Δv_{hj}	Weight adjustment value from hidden unit Z_h to hidden unit K_j
w_j	Weight from hidden unit K_j to output unit O
w_o	Bias on output unit
Δw_j	Weight adjustment value from hidden unit K_j to output unit O
$w_{j,n}$	Update weight unit j
$w_{j.o}$	Old weight unit j

$W(t)$	A stationary Gaussian white noise process with 2-side power spectral G_0
x	Original /raw input or output value
x	Relative displacement
X_{min}	Minimum of input or output value
y	Scale input or output value
$\boldsymbol{y}$	Input vector to ANNs
y_i	Input to network node i
Z_Y	The yield level
Z	The hysteretic displacement of CJ hysteretic system
z_h	Output value unit Z_h
Z_h	Hidden unit h
z_in_h	Summation value of weight input signal unit h