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Effect of Tuned Inerter Dampers (TID) on the Vibration Control of Adjacent Structures

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Abstract. In this paper, the effect of viscous dampers (VD) on the control of adjacent structures is firstly discussed, and then the tuned inerter dampers (TID) is utilized to enhance the control performance of adjacent structures. The relative displacement and absolute acceleration responses of the TID controlled adjacent structures are optimized and evaluated by the H∞ performance of the transfer functions. The results show that there is an optimal damping ratio to minimize the displacement response of the adjacent structure when VD is used, but the damping required corresponding to the optimal performance are relatively larger. Instead, the use of TID gradually enhances the control effect with the increase of inertance-mass ratio and the control effect of TID on the structure is more significant at small inertance-mass ratio. Compared with VD, TID only requires smaller damping to achieve a similar performance to VD.

Keywords. Adjacent structure, viscous damping, tuned inerter damper, H∞ optimization

1. Introduction

Structural vibration control is an effective and feasible method to reduce the dynamic response of a structure. Structural vibration control of adjacent structures can not only effectively reduce the displacement response and acceleration response of the structure due to earthquake and other excitation, but also prevent the collision of two structures due to their excessive deformation.

As early as the 1980s, researchers began to pay attention to the problem of collisions between adjacent buildings. Anagnostopoulos [1] simplified the adjacent structures into two SDOFs and investigated the effect of the mass and period of the structures on collisions; Westermo [2] proposed the use of linking beams to prevent collisions based on flexural curve analysis of adjacent structures; Kasai and Maison [3] investigated building impacts caused during the Loma Prieta earthquake and showed that adjacent buildings impacting each other can be hazardous to structures. Dampers are a type of passive energy dissipation device, and the installation of dampers between adjacent structures is a common means of control. Luco [4] minimized the peak

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amplitude of the response transfer function at the top of the higher structure near the first and second order modes of the structure by solving the optimal value of the passive damper distribution between adjacent structures; Xu [5-7] used fluid dampers to connect adjacent structures at different fundamental frequencies and selected suitable damping parameters to reduce the seismic response of the adjacent structures; Zhang [8,9] considered the stiffness of damping and investigated the use of viscoelastic damper (VED) and viscous fluid damper (VFD) to control the response caused by random earthquakes in multi-degree-of-freedom adjacent structures; AIDA and ASO [10] proposed the use of VED as passive energy dissipation devices in flexible adjacent structures; Jinkoo [11] investigated the effect of installing viscoelastic dampers in structural joints or flyovers to reduce the seismic dynamic response.

Regarding the optimization of the damping parameters, Cimellaro and Lopez-Garcia [12] proposed a passive control optimization algorithm, obtaining approximate global optimal solutions of the damping and stiffness coefficients close to those produced by active control; Bigdeli and Tesfamariam [13] investigated the optimal arrangement of a finite number of viscous dampers to significantly reduce the cost without significantly reducing the efficiency of the system; Ying [14] established a stochastic optimal coupling control strategy controlled by dissipative energy based on high-level adjacent structures; Zhu [15-17] investigated the effect of vibration control of VED and VFD in adjacent structures; Bhaskararao [18] derived the analytical solution for the optimal damping of the viscous damper at minimum steady state; Hwasung [19] considered the use of linear viscous dampers and linear springs to connect adjacent structures and found that the viscous dampers controlled the adjacent structures better than VED; Vincenzo Gattulli [20-22] reproduced the simplest elastic-viscous instantonal relationship considering both VED and VFD, considering the damper cost and the energy minimization criterion to achieve the optimal displacement or acceleration; Richardson [23] derived an analytical solution using VED connections adjacent to the structure, demonstrating that passive control is effective in reducing the structural response; Patel [24] studied that viscous dampers are effective in reducing the dynamic response of adjacent structures under seismic excitation and that optimal damping parameters exist to minimize structural displacements or accelerations; Wu [25] proposed an analytical formulation of the optimal parameters for the connection of VED represented by the Kelvin model and VFD represented by the Maxwell model, based on the principle of minimizing the average vibration energy of adjacent structures; Zhang [26] used total structural vibration energy minimization as the optimal control objective, and further showed that the damping coefficient of the kelvin model has a large effect on the total vibration energy mean square error, while the stiffness coefficient is less sensitive to it.

Research on the use of viscous dampers as well as VEDs and VFDs for vibration control of adjacent structures is relatively complete, and scholars are beginning to investigate the application of inerter-based devices to adjacent structures. Lu [27] used viscous inertial mass damper (VIMD) instead of VD to achieve vibration control of adjacent structures considering the apparent mass of the inerter; Song [28] used a TID system to mitigate potential impact and displacement damage between adjacent bridges under seismic effects and compared TID with no control device and VED and VFD in the frequency and time domains; Zhao [29] considered the use of SDI for vibration control of adjacent structures under the left and right of the soil; Lazar [30] proposed a passive control system named TID, which can achieve similar performance with the inerter at the same inertance compared with TMD.

In this paper, the control effect of tuned inerter dampers (TID) on the adjacent structure is investigated compared with viscous dampers (VD) through the coupled two single-degree-of-freedom structures. In the first part, the control effect of viscous dampers on the adjacent structure is studied by the analysis of the transfer functions of displacement and acceleration responses derived from the equations of motion, and the changes of the frequency ratio of the two adjacent structures controlled by the change of stiffness or mass are considered; the numerical solutions of the optimal parameters of VD are obtained by the H∞ based parametric optimization. In the second part, the control effect of TID on the displacement and acceleration responses of the adjacent structure is studied, and the required optimal parameters of TID and VD are analyzed and compared under the same performance.

2. Analysis of the Effect of Viscous Damper (VD)

Viscous dampers are usually used in adjacent structures, which can effectively reduce the dynamic response of the adjacent structure. In this paper, the adjacent structure is simplified to two single-degree-of-freedom structures, schematically shown in figure 1, where $m_l, m_r, c_l, c_r, k_l, k_r$ represent the mass, damping and stiffness of the left and right structures, respectively. Adjacent structures are connected by control devices as connection elements. The connection elements VD and TID are also shown in figure 1, where m_t, c_t, k_t represent the inertance, damping and stiffness parameters of the control device.

The VD damping optimum parameters are not significantly affected by the damping parameters of the structure itself [23], therefore, the damping ratio of the left and right structures is assumed to be 0.05, i.e., $\zeta_L = \zeta_R = 0.05$, and the left structure period is 1s. The equation of motion of the structure adjacent to the viscous damper connection is Eq. 1.

$$\begin{pmatrix} m_L & 0 \\ 0 & m_R \end{pmatrix}\begin{Bmatrix} \ddot{x}_L \\ \ddot{x}_R \end{Bmatrix} + \begin{pmatrix} c_L + c_t & -c_t \\ -c_t & c_R + c_t \end{pmatrix}\begin{Bmatrix} \dot{x}_L \\ \dot{x}_R \end{Bmatrix} + \begin{pmatrix} k_L & 0 \\ 0 & k_R \end{pmatrix}\begin{Bmatrix} x_L \\ x_R \end{Bmatrix} = -\begin{Bmatrix} m_L \\ m_R \end{Bmatrix}\ddot{x}_g \#(1)$$

To facilitate the subsequent analysis, the dimensionless parameters are introduced as shown in table 1, where $\xi = c_t/(2m_L\omega_L)$ is defined as the damping ratio of the control device. Therefore the equation of motion of the VD enhanced adjacent structure is simplified to Eq. 2.

$$\begin{pmatrix} 1 & 0 \\ 0 & \lambda \end{pmatrix}\begin{Bmatrix} \ddot{x}_L \\ \ddot{x}_R \end{Bmatrix} + \begin{pmatrix} 2\zeta_L\omega_L + 2\xi\omega_L & -2\xi\omega_L \\ -2\xi\omega_L & 2\lambda\zeta_R\omega_R + c_t \end{pmatrix}\begin{Bmatrix} \dot{x}_L \\ \dot{x}_R \end{Bmatrix} + \begin{pmatrix} {\omega_L}^2 & 0 \\ 0 & {\omega_L}^2\beta^2\lambda \end{pmatrix}\begin{Bmatrix} x_L \\ x_R \end{Bmatrix} = -\begin{Bmatrix} 1 \\ \lambda \end{Bmatrix}\ddot{x}_g \#(2)$$

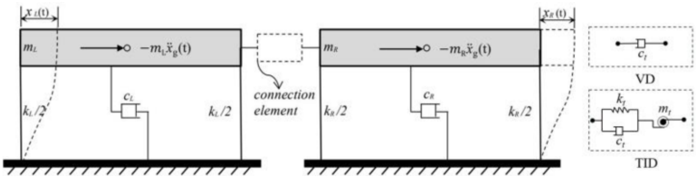

Figure 1. Simplified model of adjacent structure and connection elements.

Assuming that the input excitation is a simple harmonic excitation, i.e. $\ddot{x}_g = A_0 e^{i\omega t}$, Where A_0 is the amplitude, ω is the excitation frequency. Take the left structure as an example, the displacement $x = X_L e^{i\omega t}$, and the acceleration $\ddot{x} = A_L e^{i\omega t} = -\omega^2 X_L e^{i\omega t}$, the transfer functions of relative displacement and absolute acceleration are obtained as in Eqs. 3. and 4.

$$H_D(i\omega) = \frac{X_L}{A_0} = \frac{-m_L[-\omega^2 m_R + j\omega(c_R + c_t) + k_R] - m_R j\omega c_t}{[-\omega^2 m_L + j\omega(c_L + c_t) + k_L][-\omega^2 m_R + j\omega(c_R + c_t) + k_R] + \omega^2 {c_t}^2} \#(3)$$

$$H_A(i\omega) = \frac{A_L + A_0}{A_0} = \frac{m_L\omega^2[-\omega^2 m_R + j\omega(c_R + c_t) + k_R] + m_R j\omega c_t}{[-\omega^2 m_L + j\omega(c_L + c_t) + k_L][-\omega^2 m_R + j\omega(c_R + c_t) + k_R] + \omega^2 {c_t}^2} + 1\#(4)$$

According to table 1 the above equation is dimensionless to obtain

$$H_D(i\gamma) = \frac{1}{{\omega_L}^2}\frac{-[-\gamma^2\lambda + 2j\gamma(\zeta_R\lambda\beta + \xi) + \lambda\beta^2] - 2j\gamma\lambda\xi}{[-\gamma^2 + 2j\gamma(\zeta_L + \xi) + 1][-\gamma^2\lambda + 2j\gamma(\zeta_R\lambda\beta + \xi) + \lambda\beta^2] + 4\gamma^2\xi^2} \#(5)$$

$$H_A(i\gamma) = \frac{-\gamma^2[-\gamma^2\lambda + 2j\gamma(\zeta_R\lambda\beta + \xi) + \lambda\beta^2] - 2j\gamma^3\lambda\xi}{[-\gamma^2 + 2j\gamma(\zeta_L + \xi) + 1][-\gamma^2\lambda + 2j\gamma(\zeta_R\lambda\beta + \xi) + \lambda\beta^2] + 4\gamma^2\xi^2} + 1\#(6)$$

Table 1. Notations.

Notation	Definition
$\lambda = m_R/m_L$	Mass ratio of the right structure to the left
$\omega_R = \sqrt{k_R/m_R}; \omega_L = \sqrt{k_L/m_L}$	Frequency ratio of the right structure; Frequency ratio of the left structure;
$\beta = \omega_R/\omega_L$	Frequency ratio of the right structure to the left
$\beta^2\lambda = k_R/k_L$	Stiffness ratio of the right structure to the left
$\gamma = \omega/\omega_L$	Frequency ratio of the excitation to the left structure
$\zeta_L = c_L/(2m_L\omega_L)$	Damping ratio of the left structure
$\zeta_R = c_R/(2m_R\omega_R)$	Damping ratio of the right structure
$\xi = c_t/(2m_L\omega_L)$	Damping ratio of the control device
$\eta = m_t/m_L$	Inertance-mass ratio of the TID
$\varphi = k_t/k_L$	Stiffness ratio of the TID

$\xi = 0$ exactly represents the case of structure without control, denoted by $H_d(i\gamma)$ and $H_a(i\gamma)$. Taking into account the maximum response of the structure, the H_∞ parametrization of the transfer function is taken as the optimization objective, and the optimal damping parameters are found in a certain frequency ratio range to minimize the H_∞ parametrization of the response, and theH_∞ parametrization is shown in Eq. 7.

$$H_\infty = \|H(i\gamma)\|_\infty = \max_{\omega}\{H(i\gamma)\}\#(7)$$

Let the control effect of the structure under controlled compared to uncontrolled be S_D and S_A, as shown in Eq. 8.

$$S_D = \frac{H_D}{H_d}; S_A = \frac{H_A}{H_a} \#(8)$$

The closed solutions of the optimal damping ratio of relative displacement and absolute acceleration of the left and right structures are shown in Eqs. 9-12.

$$\xi_{D,L}^{opt} = \left| \frac{(1-\beta^2)(1+2\lambda)}{\sqrt{8(1+\lambda)^3(1+2\lambda+\beta^2)}} \right|;$$
$$\xi_{D,R}^{opt} = \left| \frac{(1-\beta^2)(2+\lambda)}{\sqrt{8(1+\lambda)^3(\lambda+2\beta^2+\lambda\beta^2)}} \right| \#(9-10)$$

$$\xi_{A,L}^{opt} = \left| \frac{(\beta^2-1)(\beta^2+2\lambda)}{2(\lambda+\beta^2)} \sqrt{\frac{1}{2(1+\lambda)(1+2\lambda+\beta^2)}} \right|$$
$$\xi_{A,R}^{opt} = \left| \frac{(\beta^2-1)(2\beta^2+\lambda)}{2(\lambda+\beta^2)} \sqrt{\frac{1}{2(1+\lambda)(\lambda+2\beta^2+\lambda\beta^2)}} \right| \#(11-12)$$

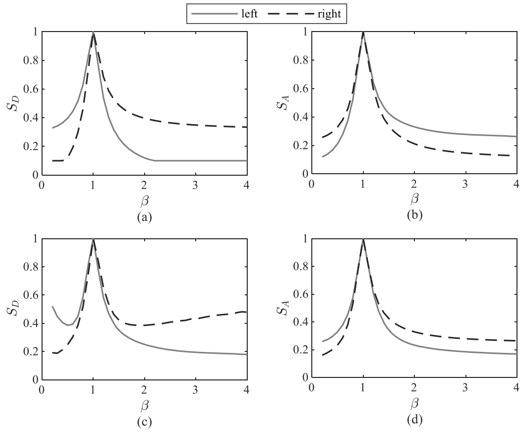

Figure 2. Control efficiency of the displacement and acceleration responses of the left and right structures under the same (a,b) mass ratio and (c,d) stiffness ratio.

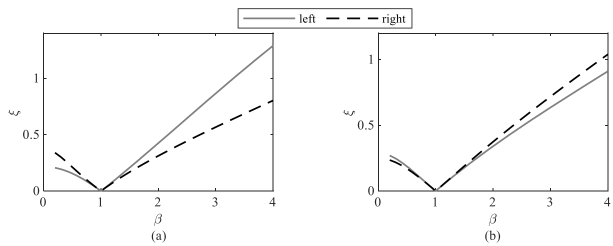

Figure 3. Required damping ratio for optimal control of (a) displacement and (b) acceleration.

In order to consider the generality of the adjacent structure, the frequency ratio of the left and right structures is taken in the range of $0.2 \leq \beta \leq 4$. The control effect of VD with the same mass and the same stiffness of the adjacent junction structure compared with that without control is shown in figure 2, where the vibration response under VD control is the H_∞ parametrically optimal solution for the left and right structures. The change of frequency ratio can be generally achieved by the change of mass ratio and the change of stiffness ratio, and the change of frequency ratio caused by changing mass or stiffness is different when the difference between the left and right frequency ratios of adjacent structures is large, and this paper studies the situation when the mass is the same.

In the vibration control using VD in a defined adjacent structure, there is an optimal damping parameter resolution solution that makes the left and right structural displacement or acceleration response optimal, and the left to right structural frequency ratio is related to the optimal solution. When the left to right structural frequency ratio is 1, the control effect is 0. The optimal damping example is shown in figure 3, where the damping ratio is taken to 1 at the point where there is actually no optimal solution in the range of structural parameters.

In the case of equal masses of left and right structures, the control effect of passive energy dissipation device is generally better when the difference of frequency ratio between left and right structures is large, while a larger damping ratio is required if VD is used for vibration control at this time. Therefore, TID is considered instead of VD to achieve vibration control of the adjacent structure.

3. Analysis of the Effect of Tuned Inerter Damping (TID)

TID is a passive energy dissipation device consisting of a spring and damping in parallel and then connected to an inerter, as shown in figure 2(b). TID can achieve a double-tuned damping effect with a wider control frequency range, and also has a damping amplification effect like TVMD. The use of TID instead of VD in the adjacent structure can effectively reduce the need for damping parameters, and the damping value required for TID is easier to achieve in combination with the actual situation.

For the TID, similarly, the optimal damping parameters and stiffness parameters are solved by determining the inertia ratio considering the H_∞ parameter of its relative displacement and absolute acceleration. To simplify the analysis, the vibration control analysis of the TID is based on the left structure, and the equations of motion of the TID are shown in Equation 13.

$$\begin{pmatrix} m_L & 0 & 0 \\ 0 & m_t + m_R & -m_t \\ 0 & -m_t & m_t \end{pmatrix} \begin{Bmatrix} \ddot{x}_L \\ \ddot{x}_R \\ \ddot{x}_t \end{Bmatrix} + \begin{pmatrix} c_L + c_t & 0 & -c_t \\ 0 & c_R & 0 \\ -c_t & 0 & c_t \end{pmatrix} \begin{Bmatrix} \dot{x}_L \\ \dot{x}_R \\ \dot{x}_t \end{Bmatrix} + \begin{pmatrix} k_L + k_t & 0 & -k_t \\ 0 & k_R & 0 \\ -k_t & 0 & k_t \end{pmatrix} \begin{Bmatrix} x_L \\ x_R \\ x_t \end{Bmatrix} = -\begin{Bmatrix} m_L \\ m_R \\ 0 \end{Bmatrix} \ddot{x}_g \#(13)$$

The frequency response functions of the relative displacement and absolute acceleration of the left structure are shown in Eqs. 14 and 15,

$$H_D(i\gamma) = \frac{(2j\omega\xi\omega_L + \omega_L{}^2\varphi)\lambda\eta\omega^2 - [C_1C_2 - \eta^2\omega^4]}{C_3[C_1C_2 - \eta^2\omega^4] - (2j\omega\xi\omega_L + \omega_L{}^2\varphi)^2 C_1} \#(14)$$

$$H_A(i\gamma) = -\frac{(2j\omega\xi\omega_L + \omega_L{}^2\varphi)\lambda\eta\omega^4 - \omega^2[C_1C_2 - \eta^2\omega^4]}{C_3[C_1C_2 - \eta^2\omega^4] - (2j\omega\xi\omega_L + \omega_L{}^2\varphi)^2 C_1} + 1\#(15)$$

where

$$C_1 = (-(\lambda+\eta)\omega^2 + 2j\omega\zeta_R\beta\omega_L + \omega_L{}^2\beta^2\lambda);\ C_2 = (-\omega^2\eta + 2j\omega\xi\omega_L + \omega_L{}^2\varphi);$$

$$C_3 = -\omega^2 + j\omega(2\zeta_L\omega_L + 2\xi\omega_L) + (\omega_L{}^2 + \omega_L{}^2\varphi)$$

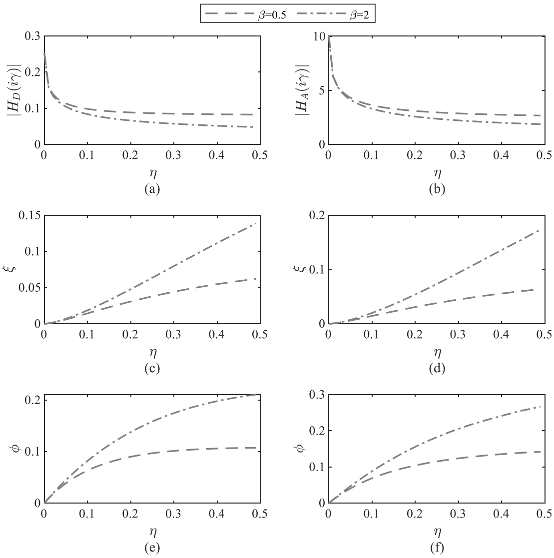

Figure 4. Optimal perforamce of the response of TID on the left structure and the corresponding required damping and stiffness when β= 0.5 and β=2. (a,c,e) relative displacement; (b,d,f) absolute acceleration.

The $\|H_D(i\gamma)\|_\infty$ and $\|H_A(i\gamma)\|_\infty\|$ of the left structure are optimized respectively to obtain the optimal damping and stiffness parameters corresponding to the determination in the range of inertia mass ratio $0 \le \eta \le 0.5$. When the inertia ratio of the TID is determined, there exist optimal damping and stiffness parameters that minimize the H_∞ parameter of the structural response. Without loss of generality, the variation of TID optimal damping ratio and stiffness ratio with inertia ratio for two cases of frequency ratio $\beta = 0.5$ and $\beta = 2$ are considered, as shown in figure 4. The structural response decreases as the inertance-mass ratio η increases, and no optimal η exists. In the range of small η, the control effect of TID on the structure as well as more obvious, the optimal damping parameters and stiffness parameters increase with the increase of η, and roughly in a linear relationship. After η increases to a certain degree, the response curve of the structure becomes flat, indicating that the vibration control effect produced by increasing η in this range is small, and the demand for damping and stiffness continues to increase by increasing η. Therefore, the inertia ratio should not be too large when using TID for vibration control of the structure.

When the difference between the left and right structure frequency ratios is too large, the optimal control effect produced by variable mass and variable stiffness differs greatly, so the optimal damping parameters in the range of frequency ratio $0.2 \leq \beta \leq 2$ are considered. When the TID achieves almost the same control effect as VD, the damping parameter of the TID is substantially reduced compared to VD, as shown in figures 5(b), (d). Since the left and right structures vibrate at the same time when the frequency ratio $\beta = 1$, no displacement difference and acceleration difference is generated at both ends of the TID, so the control effect is the worst at this time. The effect of TID on the control of displacement and acceleration is gradually obvious when the difference between the left and right structure frequencies is too large, that is, when β is far from 1, and the required damping parameters increase. Using TID instead of VD can effectively reduce the demand of damping parameters for the structure, which is easier to implement in practical applications.

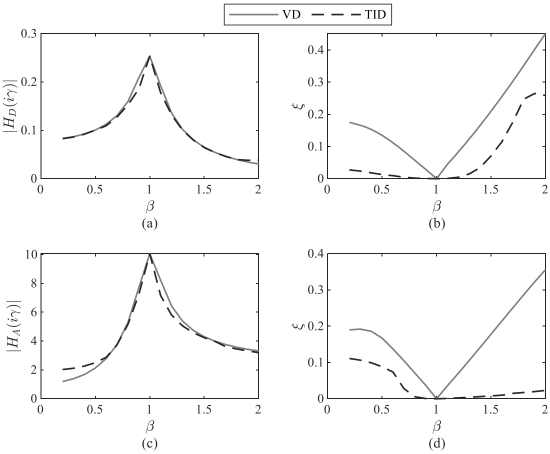

Figure 5. Comparison of the control performance and required damping of VD and TID. (a,b) relative displacement; (c,d) absolute acceleration.

4. Conclusion

In this paper, the vibration control of the adjacent structure using TID is analyzed compared with VD. First, the equation of motion of the VD system is established on the basis of two coupled single-degree-of-freedom, and the optimal damping values of the VD at different frequency ratios are analyzed; second, the TID is introduced to the adjacent structure, and the optimization of the optimal control parameters of TID based on H_∞ norm is carried out; finally, a comparative analysis is carried out on two multi-degree-of-freedom adjacent structures using VD and TID The main conclusions are as follows.

(1) When using VD for vibration control of adjacent structures, there are optimal damping parameters that minimize the structural displacement response or acceleration response, and the greater the difference between the frequency ratios of the left and right structures, the better the control effect and the higher the required damping parameters.

(2) Adjacent to the structure by the mass change or stiffness change can cause the change of frequency ratio, but the optimal parameters of VD corresponding to the two

cases are more obvious when the difference between the left and right structure frequency ratio is large;

(3) Using TID instead of VD to provide tuned damping for vibration control, with the increase of TID inertia ratio the control effect is gradually enhanced; at a small inertia ratio (less than 0.2), the TID on the structure; At small inertance-mass ratio (less than 0.2), the control effect of TID on the structure has been more significant, at this time, the damping ratio and stiffness ratio of TID increases with the increase of inertance-mass ratio, almost in a linear relationship.

(4) Compared with VD, TID only needs smaller damping parameters to achieve the same control effect as VD; the inertia ratio required for TID to achieve the same control effect as VD is relatively larger when the frequency ratio of the left and right structures differs significantly.

References

[1] Anagnostopoulos SA. Pounding of buildings in series during earthquakes. Earthquake Engineering & Structural Dynamics. 1988; 16(3): 443-456.

[2] Westermo BD. The dynamics of interstructural connection to prevent pounding. Earthquake Engineering & Structural Dynamics. 1989; 18(5): 687-699.

[3] Kasai K and Maison BF. Building pounding damage during the 1989 Loma Prieta earthquake. Engineering Structures. 1997; 19(3): 195-207.

[4] Luco JE and De Barros FCP. Optimal damping between two adjacent elastic structures. Earthquake Engineering & Structural Dynamics. 1998; 27(7): 649-659.

[5] Xu YL, He Q and Ko JM. Dynamic response of damper-connected adjacent buildings under earthquake excitation. Engineering Structures. 1999; 21(2): 135-148.

[6] Xu YL, et al. Experimental investigation of adjacent buildings connected by fluid damper. Earthquake Engineering & Structural Dynamics. 1999; 28(6): 609-631.

[7] Yang Z, Xu YL and Lu XL. Experimental seismic study of adjacent buildings with fluid dampers. Journal of Structural Engineering-ASCE. 2003; 129(2): 197-205.

[8] Zhang WS and Xu YL. Dynamic characteristics and seismic response of adjacent buildings linked by discrete dampers. Earthquake Engineering & Structural Dynamics. 1999; 28(10): 1163-1185.

[9] Zhang WS and Xu YL. Vibration analysis of two buildings linked by Maxwell model-defined fluid dampers. Journal of Sound and Vibration. 2000; 233(5): 775-796.

[10] Aida T, et al. Improvement of the structure damping performance by interconnection. Journal of Sound and Vibration. 2001; 242(2): 333-353.

[11] Kim J, Ryu J and Chung L. Seismic performance of structures connected by viscoelastic dampers. Engineering Structures. 2006; 28(2): 183-195.

[12] Cimellaro GP and Lopez-Garcia D. Algorithm for design of controlled motion of adjacent structures. Structural Control & Health Monitoring. 2011; 18(2): 140-148.

[13] Bigdeli K, Hare W and Tesfamariam S. Configuration optimization of dampers for adjacent buildings under seismic excitations. Engineering Optimization. 2012; 44(12): 1491-1509.

[14] Ying ZG, Ni YQ and Ko JM. Seismic response mitigation of adjacent high-rise structures via stochastic optimal coupling-control. Smart Structures and Materials 2001 Conference. 2001; Newport Beach, Ca.

[15] Zhu HP, Wen YP and Iemura H. A study on interaction control for seismic response of parallel structures. Computers & Structures. 2001; 79(2): 231-242.

[16] Zhu HP and Xu YL. Optimum parameters of Maxwell model-defined dampers used to link adjacent structures. Journal of Sound and Vibration. 2005; 279(1-2): 253-274.

[17] Zhu HP, Ge DD and Huang X. Optimum connecting dampers to reduce the seismic responses of parallel structures. Journal of Sound and Vibration. 2011; 330(9): 1931-1949.

[18] Bhaskararao AV and Jangid RS. Optimum viscous damper for connecting adjacent SDOF structures for harmonic and stationary white-noise random excitations. Earthquake Engineering & Structural Dynamics. 2007; 36(4): 563-571.

[19] Roh H, Cimellaro GP and Lopez-Garcia D. Seismic response of adjacent steel structures connected by passive device. Advances in Structural Engineering. 2011; 14(3): 499-517.

[20] Gattulli V, Potenza F and Lepidi M. Damping performance of two simple oscillators coupled by a visco-elastic connection. Journal of Sound and Vibration. 2013; 332(26): 6934-6948.

[21] Gattulli V, Potenza F and Spencer BF. Design criteria for dissipative devices in coupled oscillators under seismic excitation. Structural Control & Health Monitoring. 2018; 25(7).
[22] Gattulli V, Potenza F and Di Sabatino U. Dissipative coupling for the seismic enhancement of adjacent structures. Engineering Structures. 2019; 199.
[23] Richardson A, Walsh KK and Abdullah MM. Closed-form equations for coupling linear structures using stiffness and damping elements. Structural Control & Health Monitoring. 2013; 20(3): 259-281.
[24] Patel CC and Jangid RS. Dynamic response of identical adjacent structures connected by viscous damper. Structural Control & Health Monitoring. 2014; 21(2): 205-224.
[25] Wu QY, Dai JZ and Zhu HP. Optimum design of passive control devices for reducing the seismic response of twin-tower-connected structures. Journal of Earthquake Engineering. 2018; 22(5): 826-860.
[26] Zhang SR, et al., Performance-based compositive passive control analysis of multi-tower building with chassis: Optimization of kelvin-voigt dampers. Buildings. 2022; 12(2).
[27] Lu L, et al. Viscous inertial mass damper (VIMD) for seismic responses control of the coupled adjacent buildings. Engineering Structures. 2021; 233.
[28] Song J, et al. Seismic responses of adjacent bridge structures coupled by tuned inerter damper. Engineering Structures. 2021; 243.
[29] Zhao ZP, et al., Interaction of two adjacent structures coupled by inerter-based system considering soil conditions. Journal of Earthquake Engineering. 2022; 26(6): 2867-2887.
[30] Lazar IF, Neild SA and Wagg DJ. Using an inerter-based device for structural vibration suppression. Earthquake Engineering & Structural Dynamics. 2014; 43(8): 1129-1147.