



圖 1.1 台北國際金融大樓與單擺式 TMD 系統

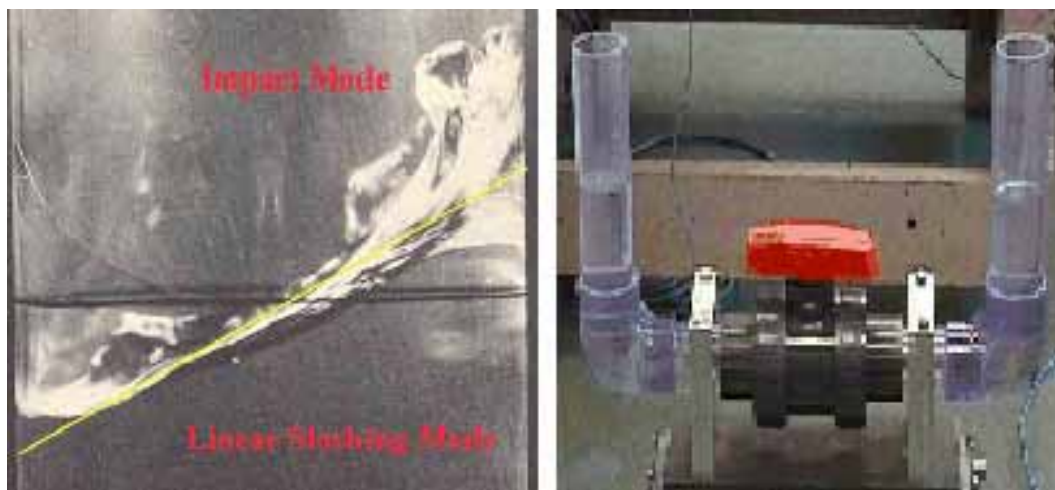


圖 1.2 不同型式之調諧液態消能系統

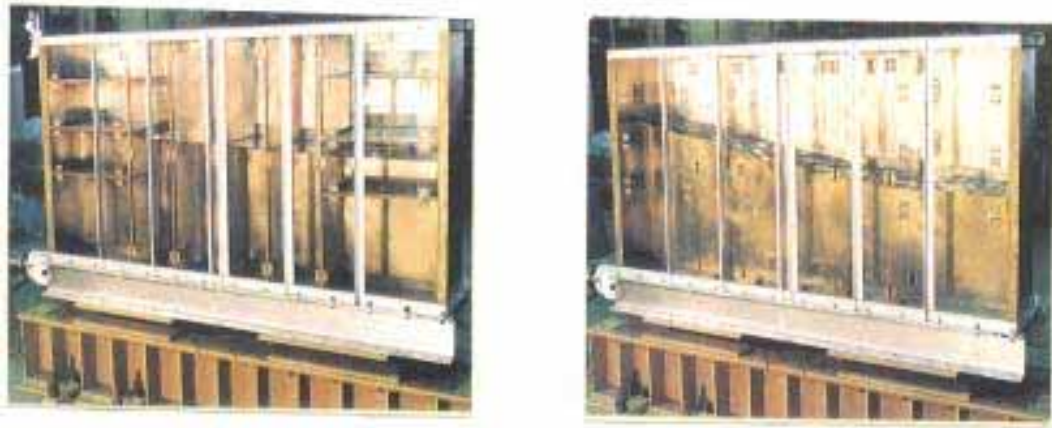


圖 1.3 Aqua Damper(Tuned Slushing Water Damper)

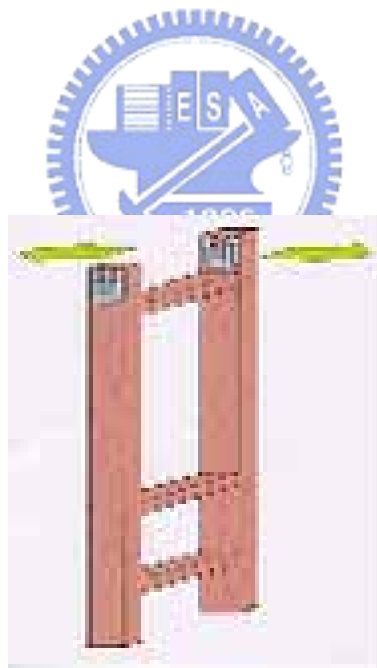


圖 1.4 U 形 TLCD 系統於橋塔之減振應用

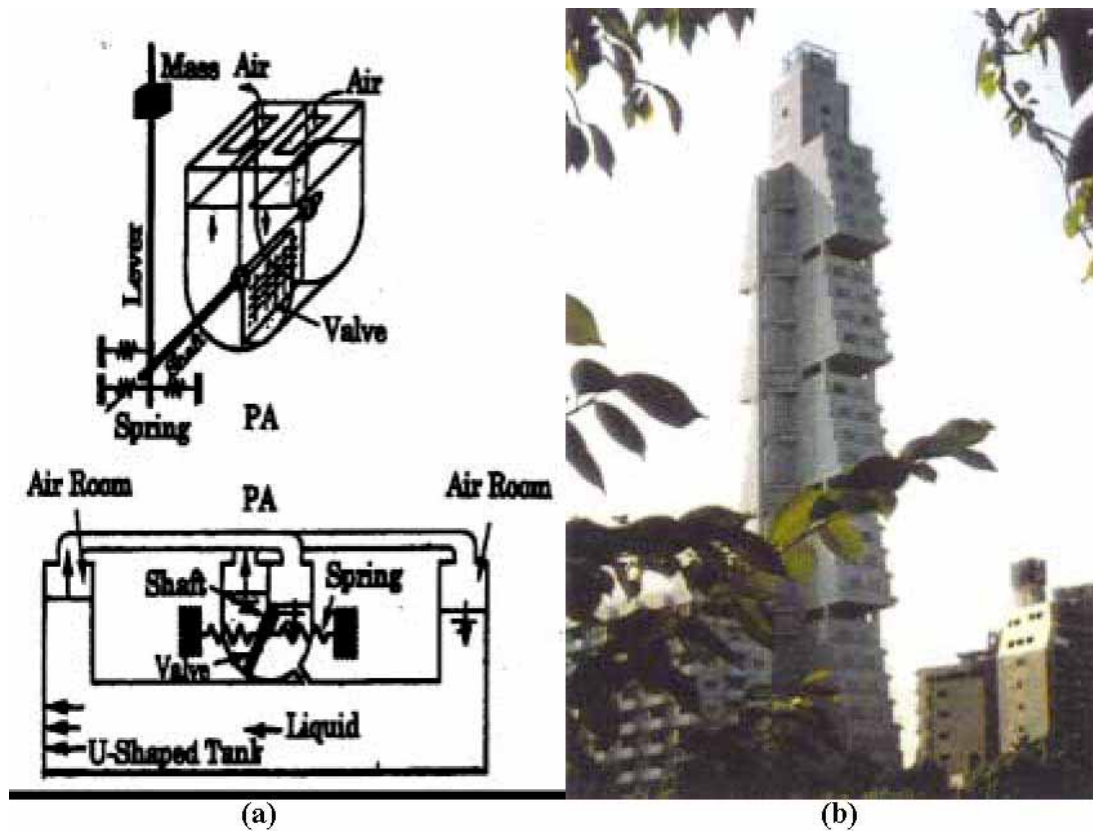


圖 1.5 TLCD 系統於東京 Cosima 旅館之減振應用

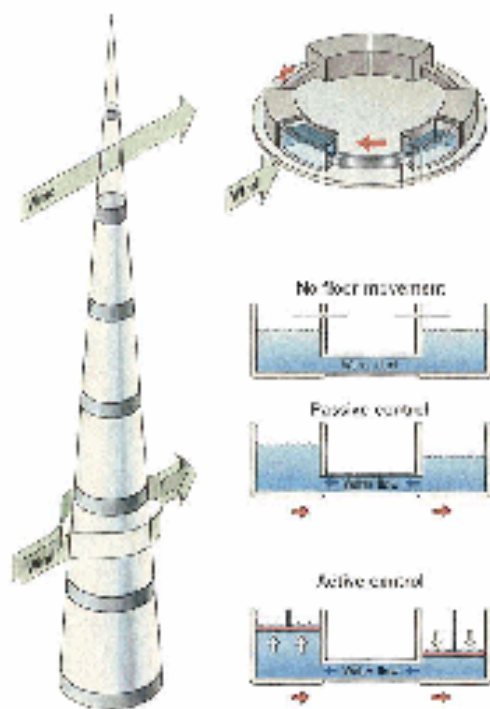


圖 1.6 TLCD 系統於東京千禧塔之減振應用

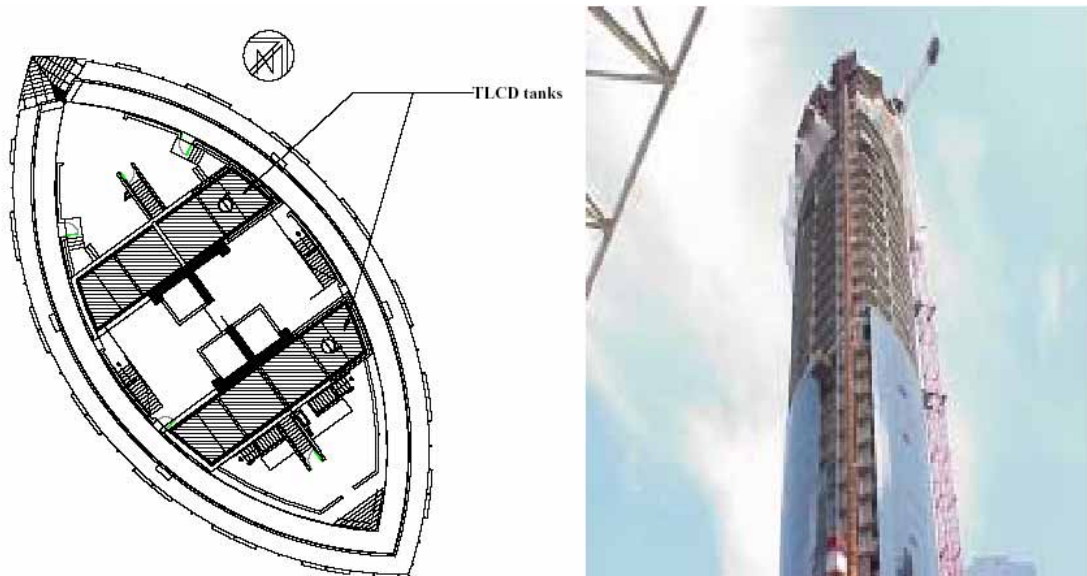


圖 1.7 TLCD 系統於加拿大 Wall center 之減振應用

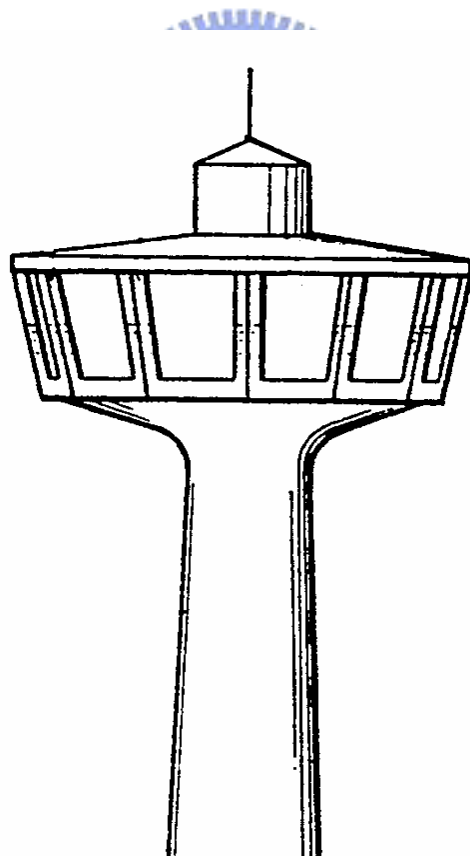


圖 1.8 TLCD 系統於高塔之減振應用

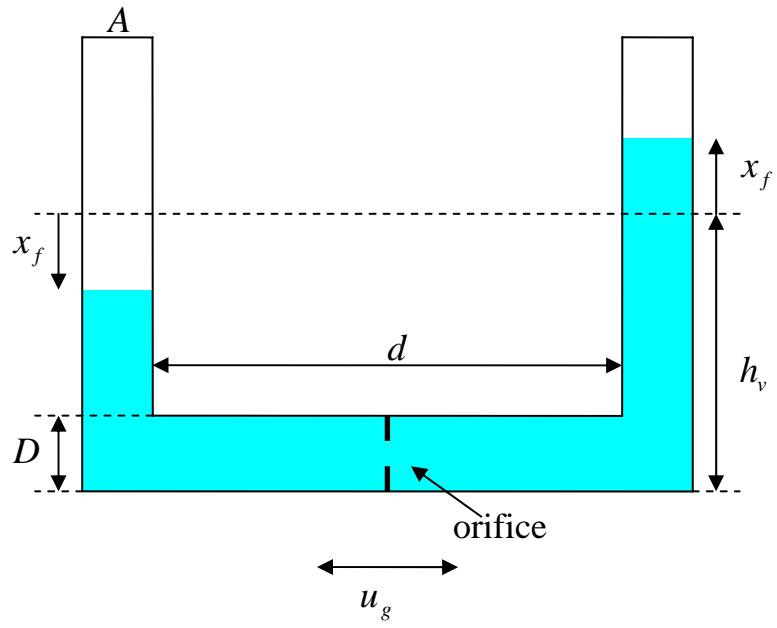


圖 2.1 等斷面 TLCD 之示意圖

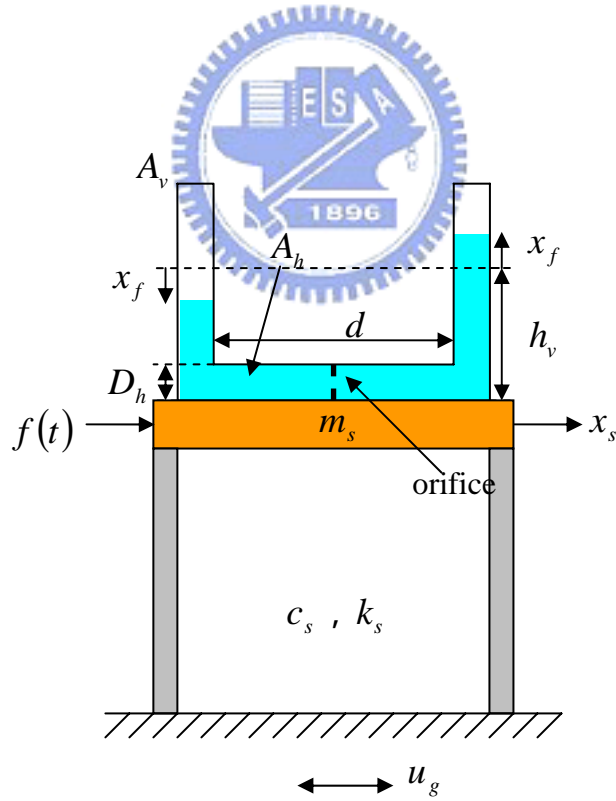


圖 2.2 單自由度結構物裝置等斷面 TLCD 示意圖

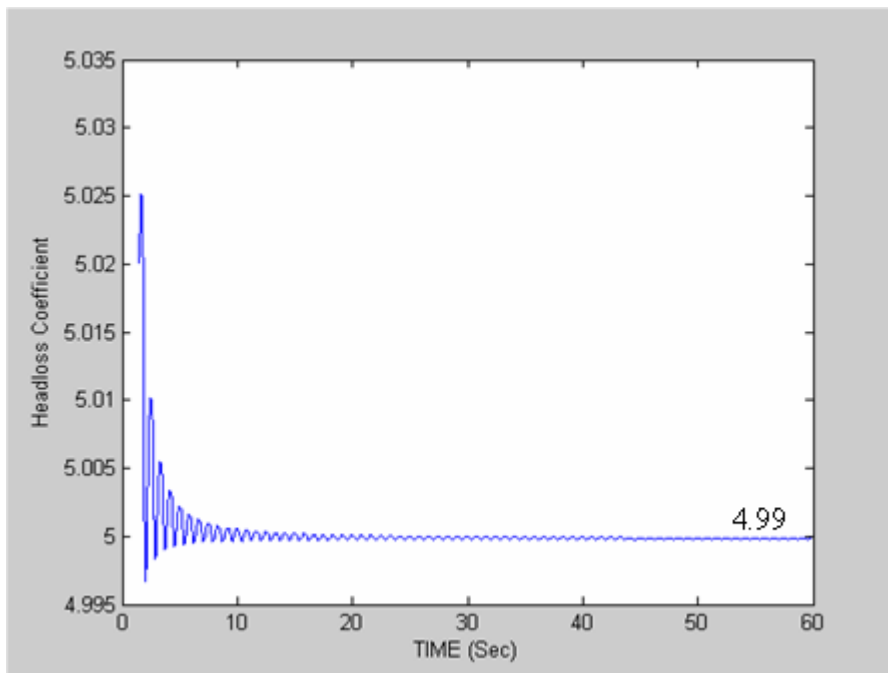


圖 2.3 系統識別所得之水頭損失係數歷時



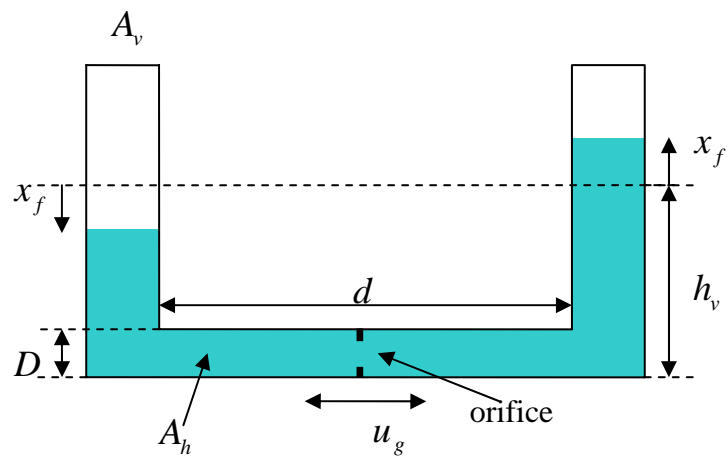


圖 3.1 變斷面 VTLCD 之示意圖

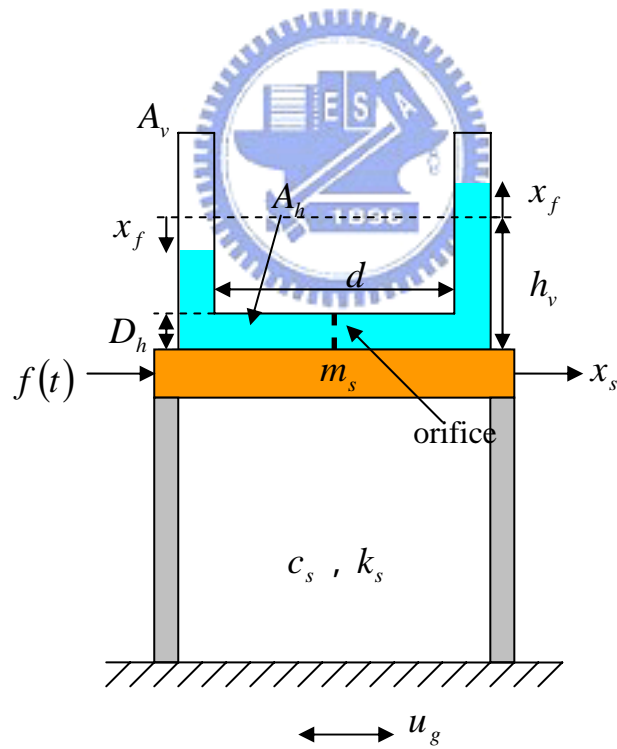


圖 3.2 單自由度結構裝置變斷面 VTLCD 示意圖

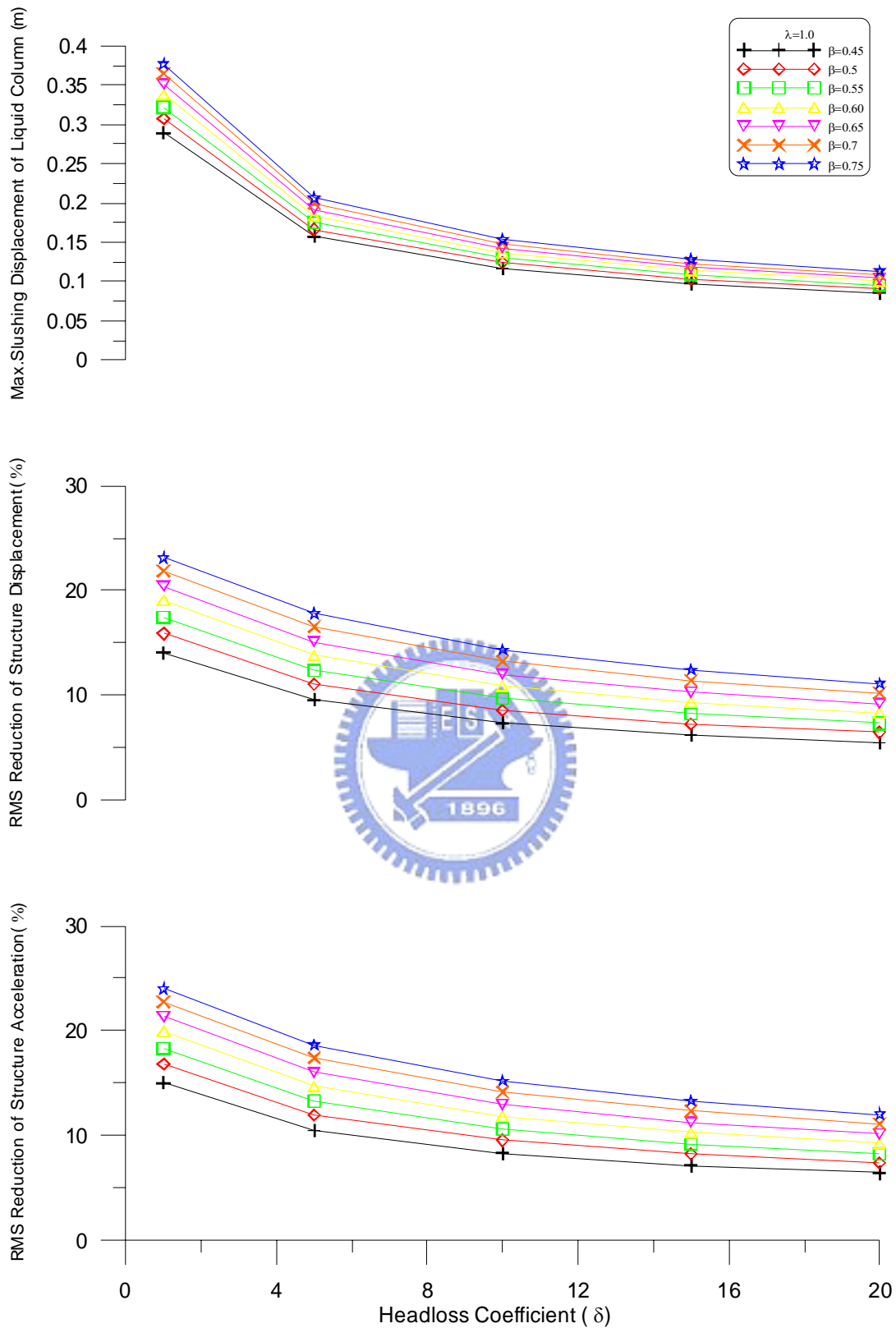


圖 3.3(a) 水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(自由振動,  $x_s(0)=0.1\text{m}$ ,  $\gamma=1$ ,  $\lambda=1.0$ )



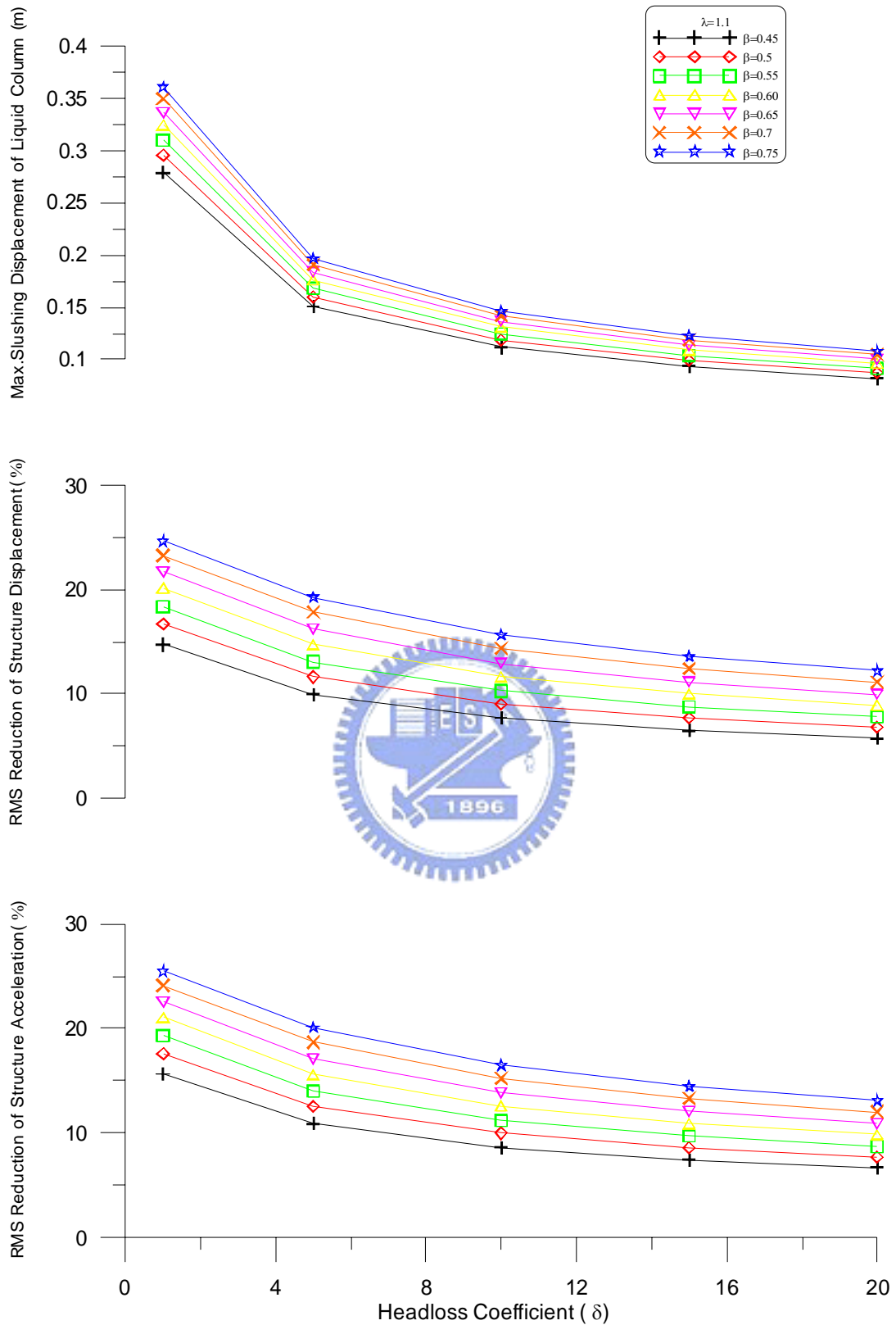


圖 3.3(b) 水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(自由振動,  $x_s(0)=0.1\text{m}$ ,  $\gamma=1$ ,  $\zeta=1\%$ ,  $\lambda=1.1$ )

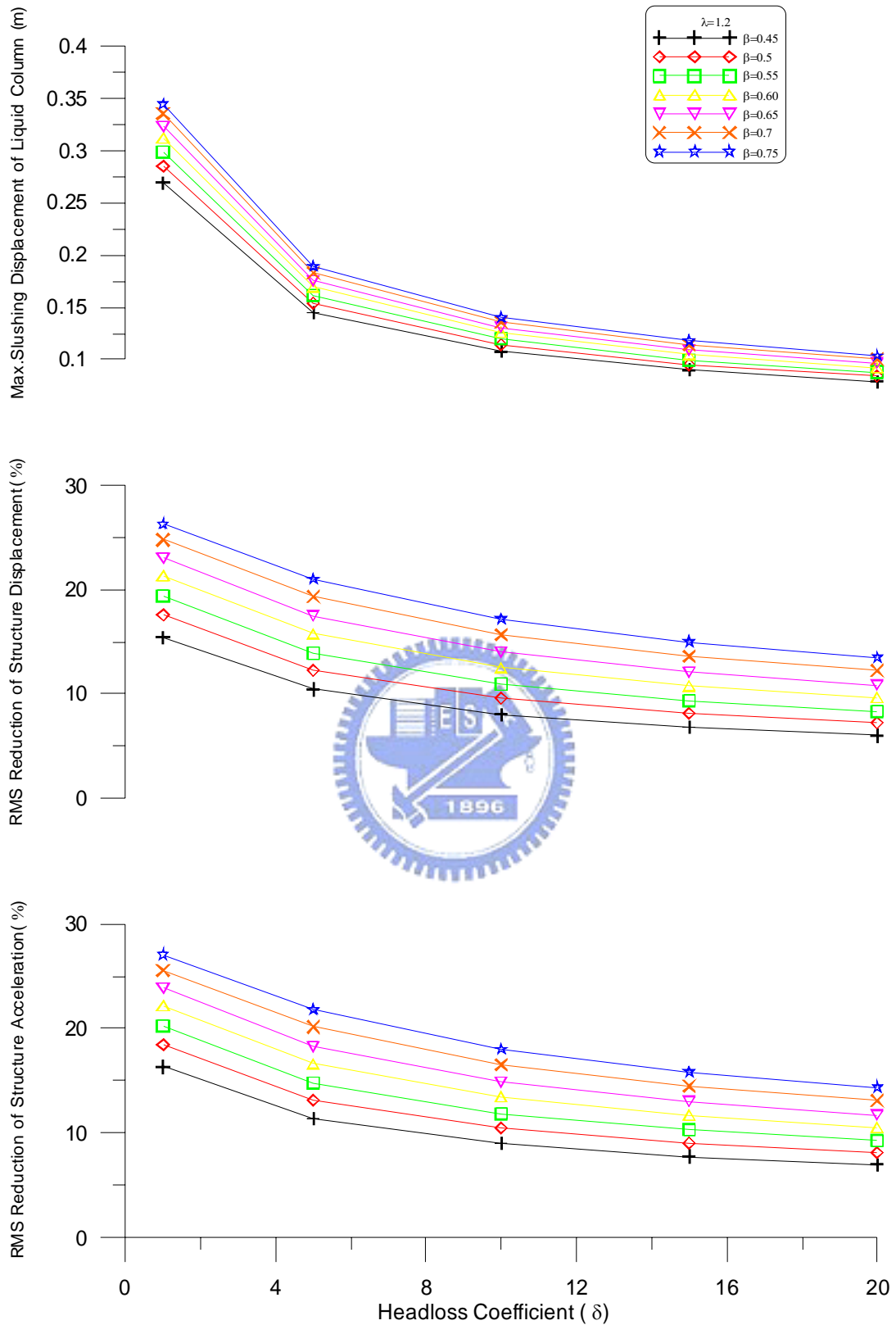


圖 3.3(c) 水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(自由振動,  $x_s(0)=0.1\text{m}$ ,  $\gamma=1$ ,  $\zeta=1\%$ ,  $\lambda=1.2$ )

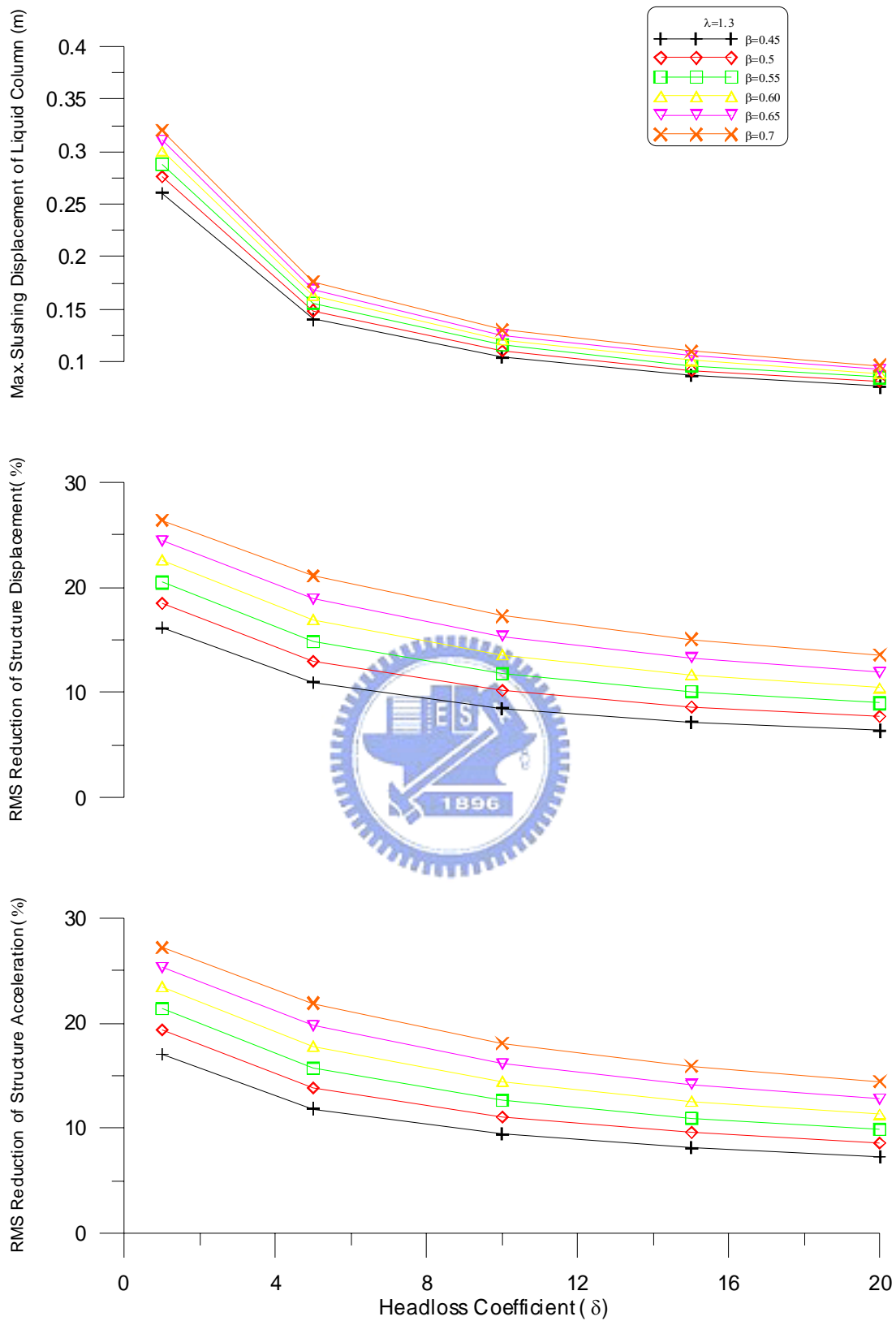


圖 3.3(d)水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(自由振動,  $x_s(0)=0.1\text{m}$ ,  $\gamma=1$ ,  $\zeta=1\%$ ,  $\lambda=1.3$ )

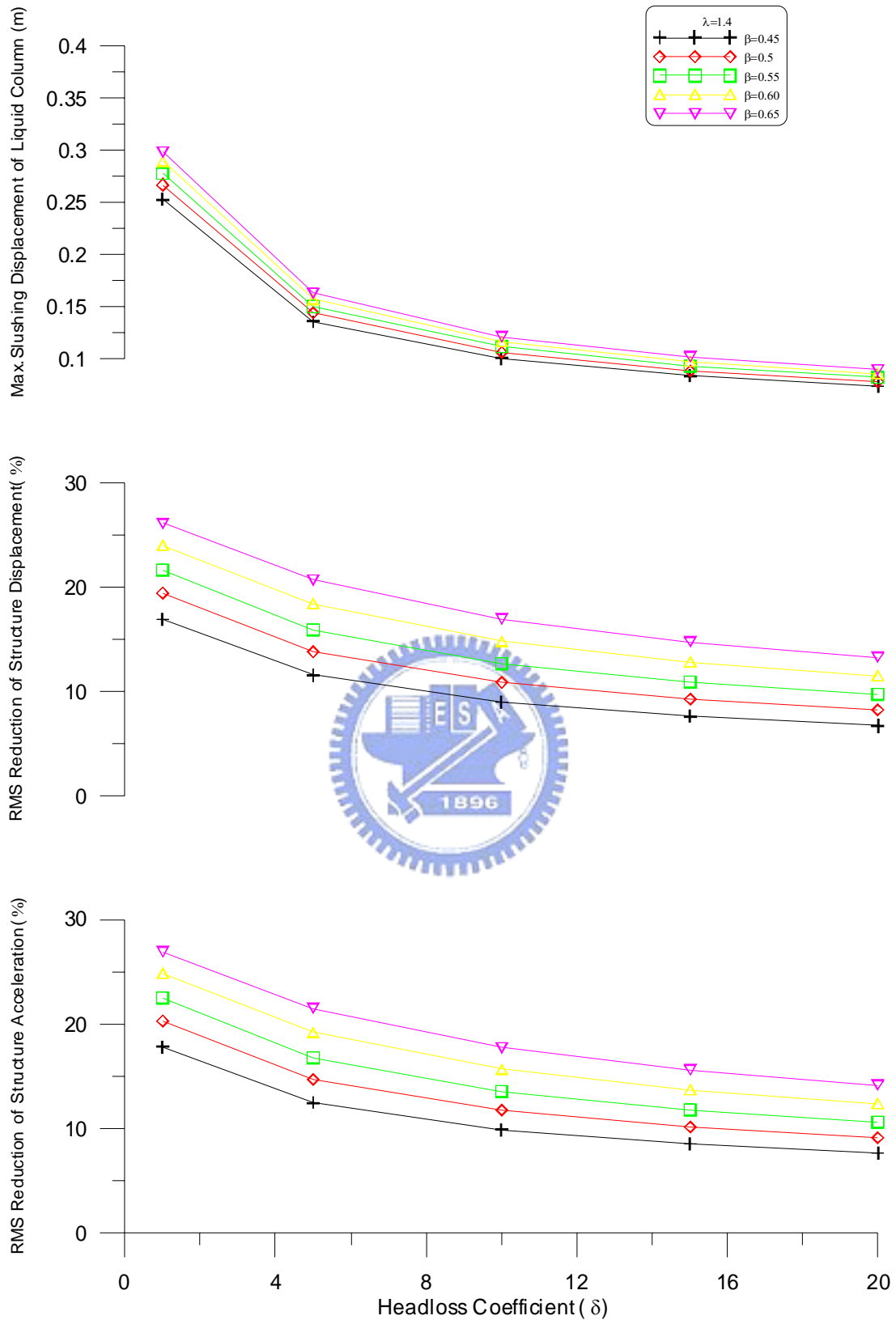


圖 3.3(e) 水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(自由振動,  $x_s(0)=0.1\text{m}$ ,  $\gamma=1$ ,  $\zeta=1\%$ ,  $\lambda=1.4$ )

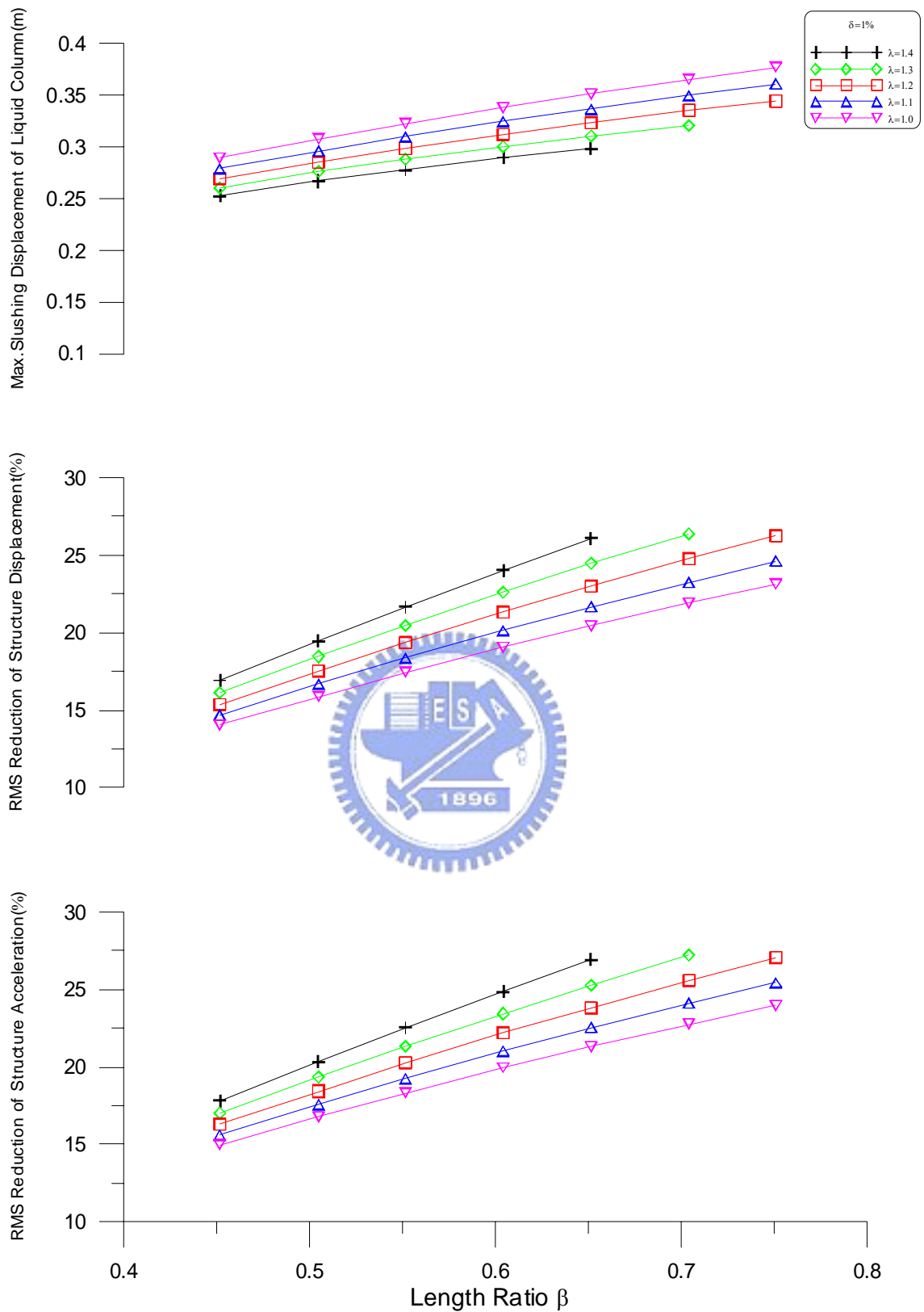


圖 3.4(a) 截面積比與水平長度比對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(自由振動,  $x_s(0)=0.1\text{m}$ ,  $\gamma=1$ ,  $\delta=1.0$ ,  $\delta=1\%$ )

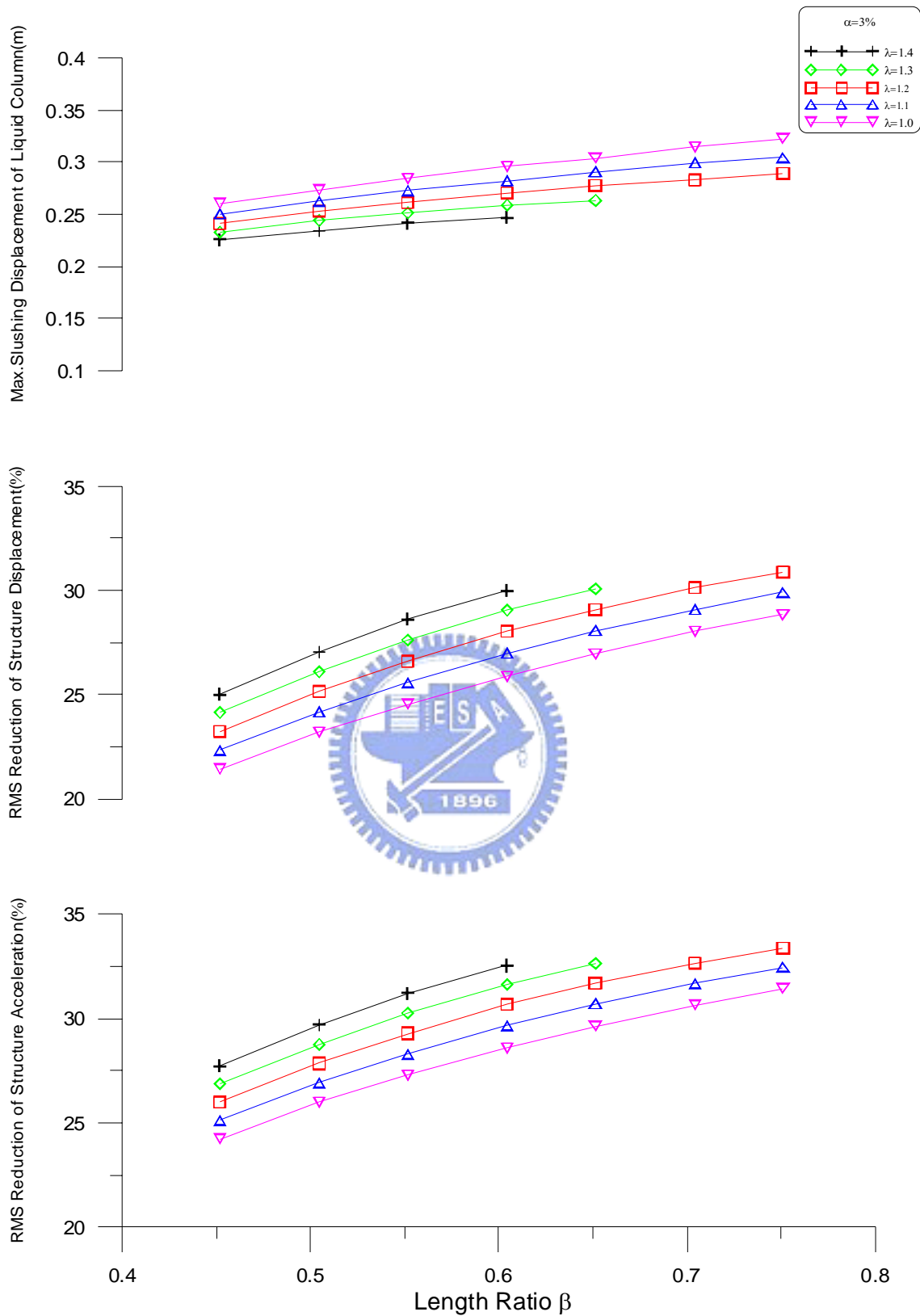


圖 3.4(b) 截面積比與水平長度比對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(自由振動,  $x_s(0)=0.1\text{m}$ ,  $\gamma=1$ ,  $\lambda=1.0$ ,  $\alpha=3\%$ )

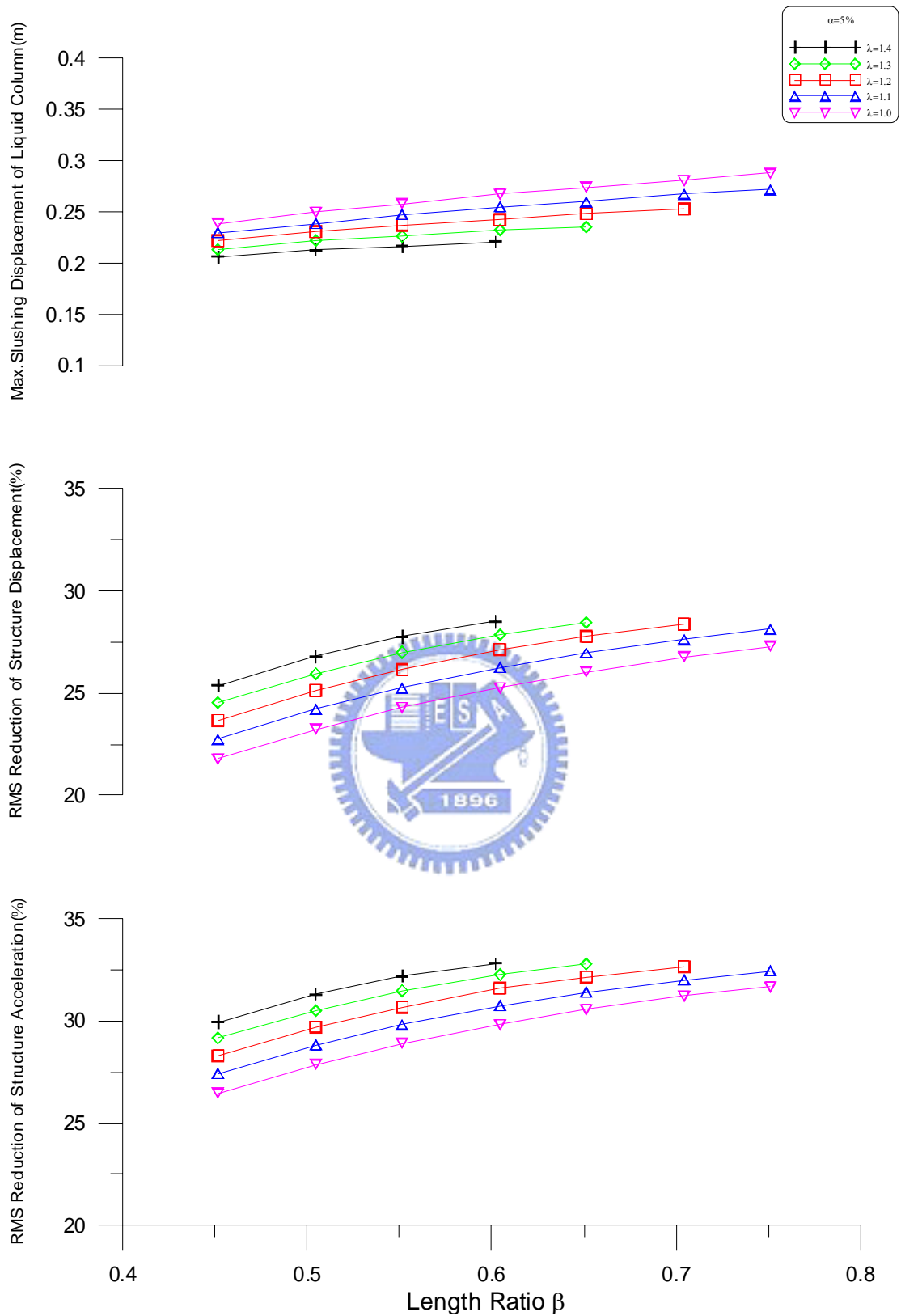


圖 3.4(c) 截面積比與水平長度比對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(自由振動,  $x_s(0)=0.1\text{m}$ ,  $\gamma=1$ ,  $\lambda=1.0$ ,  $\alpha=5\%$ )

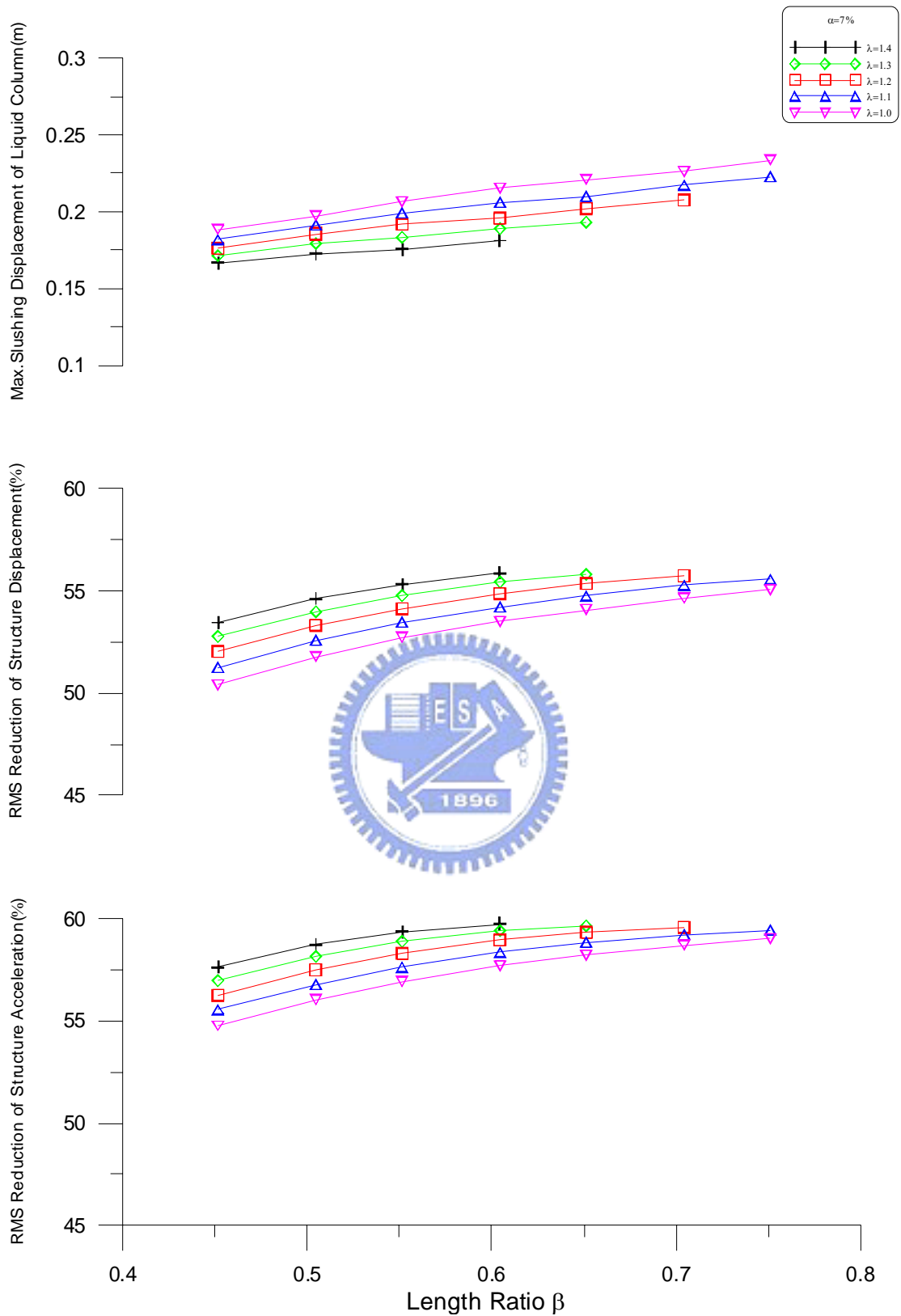


圖 3.4(c) 截面積比與水平長度比對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(自由振動,  $x_s(0)=0.1\text{m}$ ,  $\gamma=1$ ,  $\lambda=1.0$ ,  $\alpha=7\%$ )



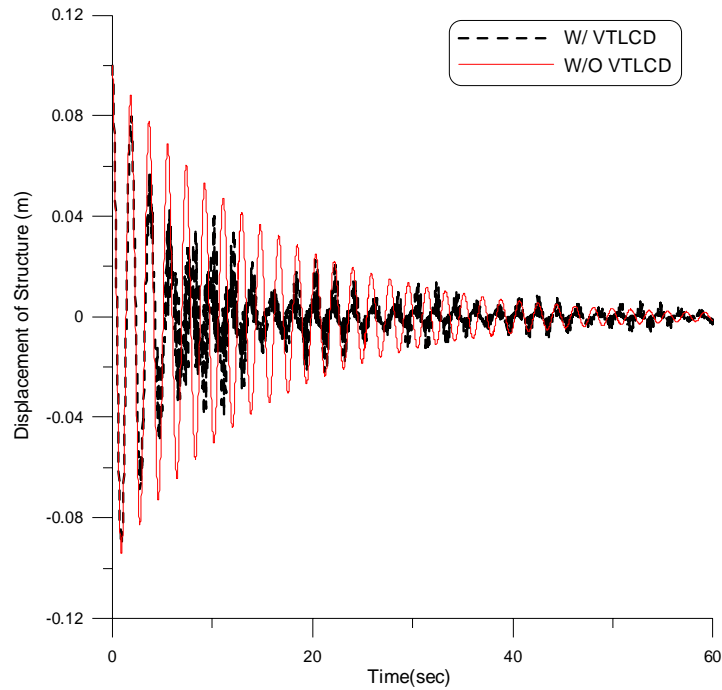


圖 3.5 VTLCD 系統控制與未控制結構之位移歷時比較(自由振動 ,

$$x_s(0) = 0.1\text{m} , \gamma = 1 , \alpha = 5.0\% , \beta = 0.45 , \delta = 1 , \lambda = 1.4)$$

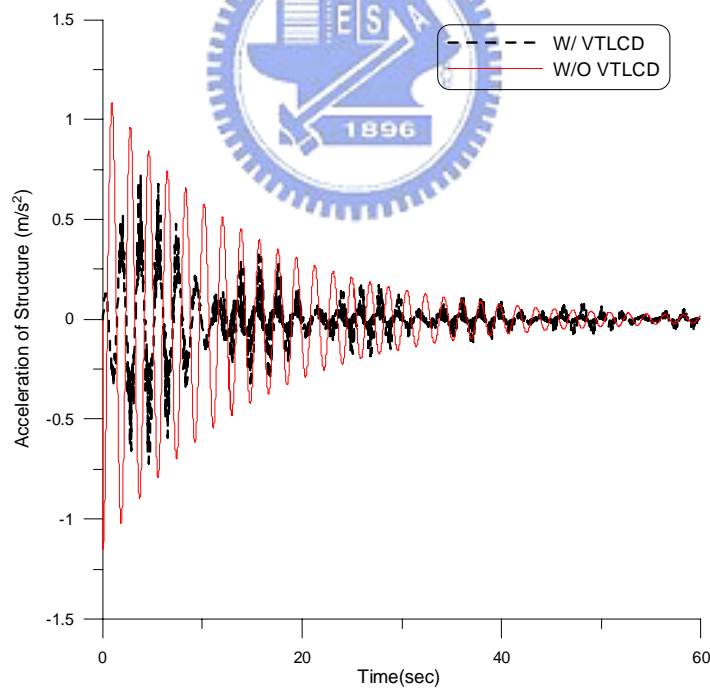


圖 3.6 VTLCD 系統控制與未控制結構之加速度歷時比較(自由振動 ,

$$x_s(0) = 0.1\text{m} , \gamma = 1 , \alpha = 5.0\% , \beta = 0.45 , \delta = 1 , \lambda = 1.4)$$

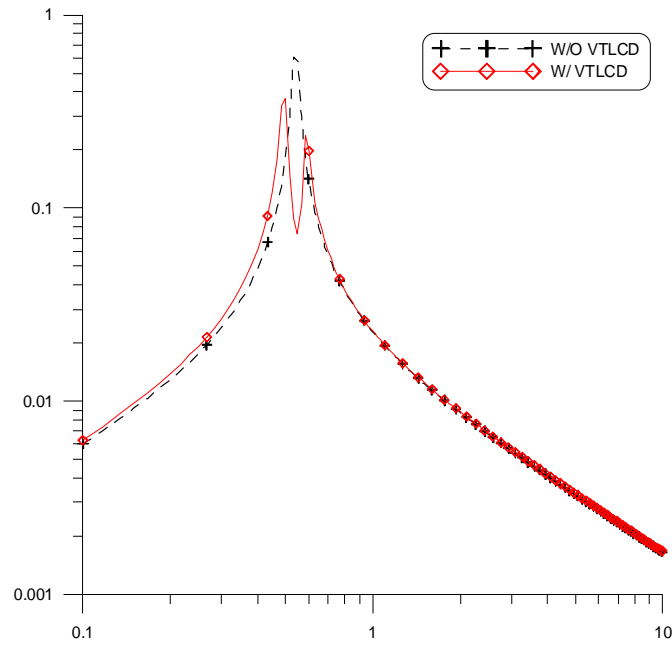


圖 3.7 VTLCD 系統控制與未控制結構之位移富氏頻譜圖(自由振動 ,  $x_s(0) = 0.1\text{m}$  ,  $\gamma = 1$  ,  $\alpha = 5.0\%$  ,  $\beta = 0.45$  ,  $\delta = 1$  ,  $\lambda = 1.4$ )

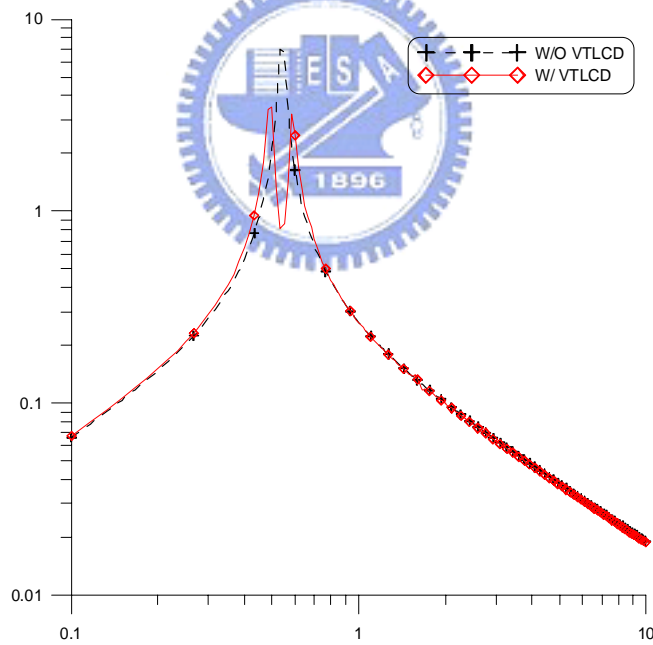


圖 3.8 VTLCD 系統控制與未控制結構之加速度富氏頻譜圖(自由振動 ,  $x_s(0) = 0.1\text{m}$  ,  $\gamma = 1$  ,  $\alpha = 5.0\%$  ,  $\beta = 0.45$  ,  $\delta = 1$  ,  $\lambda = 1.4$ )

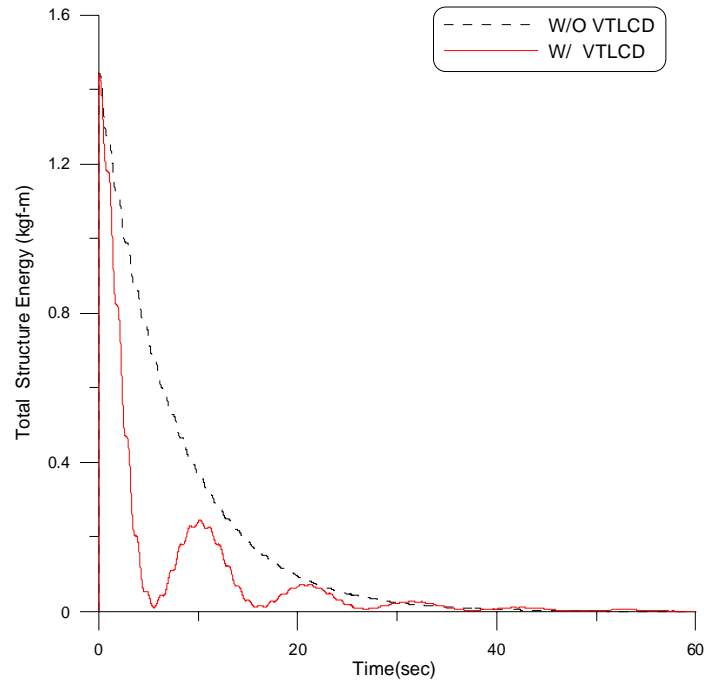


圖 3.9 VTLCD 系統控制與未控制結構之瞬時總能量歷時(自由振動 ,  
 $x_s(0) = 0.1\text{m}$  ,  $\gamma = 1$  ,  $\alpha = 5.0\%$  ,  $\beta = 0.45$  ,  $\delta = 1$  ,  $\lambda = 1.4$ )

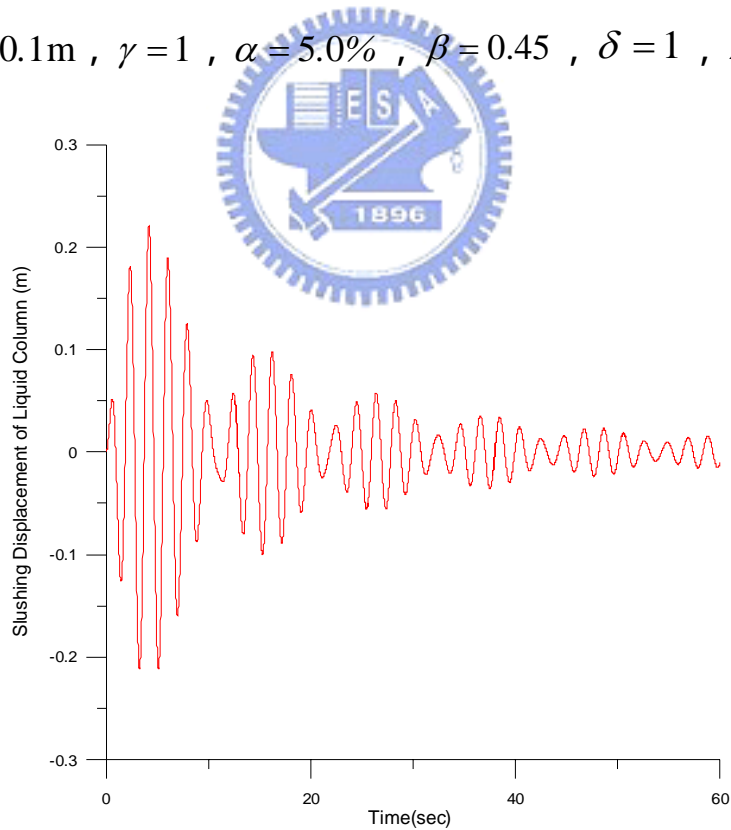


圖 3.10 變斷面 VTLCD 系統水柱激盪位移歷時(自由振動 ,  
 $x_s(0) = 0.1\text{m}$  ,  $\gamma = 1$  ,  $\alpha = 5.0\%$  ,  $\beta = 0.45$  ,  $\delta = 1$  ,  $\lambda = 1.4$ )

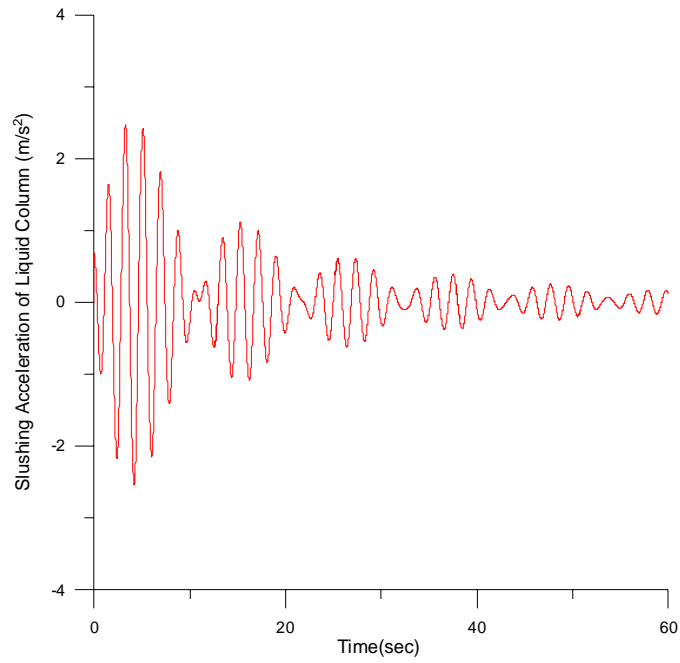


圖 3.11 變斷面 VTLCD 系統水柱激盪加速度歷時(自由振動 ,  
 $x_s(0) = 0.1\text{m}$  ,  $\gamma = 1$  ,  $\alpha = 5.0\%$  ,  $\beta = 0.45$  ,  $\delta = 1$  ,  $\lambda = 1.4$ )



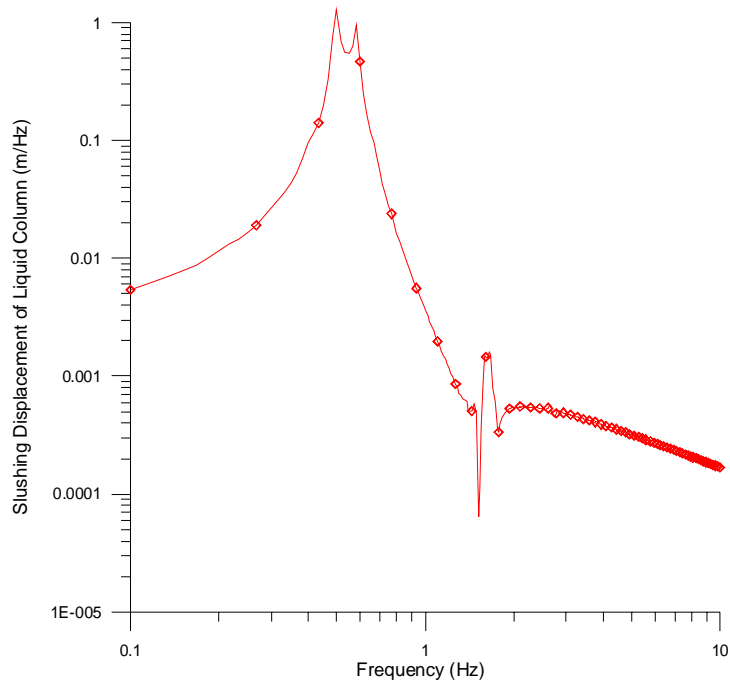


圖 3.12(a) 變斷面 VTLCD 系統水柱激盪位移富氏頻譜圖(自由振動 ,  
 $x_s(0) = 0.1\text{m}$  ,  $\gamma = 1$  ,  $\alpha = 5.0\%$  ,  $\beta = 0.45$  ,  $\delta = 1$  ,  $\lambda = 1.4$ )

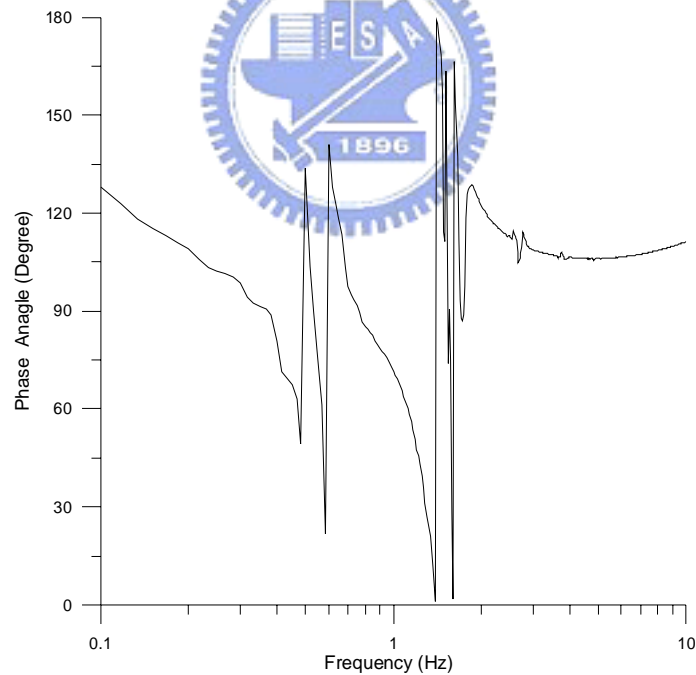


圖 3.12(b) VTLCD 系統之水柱激盪位移反應富氏頻譜之相位角(自由  
振動 ,  $x_s(0) = 0.1\text{m}$  ,  $\gamma = 1$  ,  $\alpha = 5.0\%$  ,  $\beta = 0.45$  ,  $\delta = 1$  ,  $\lambda = 1.4$ )

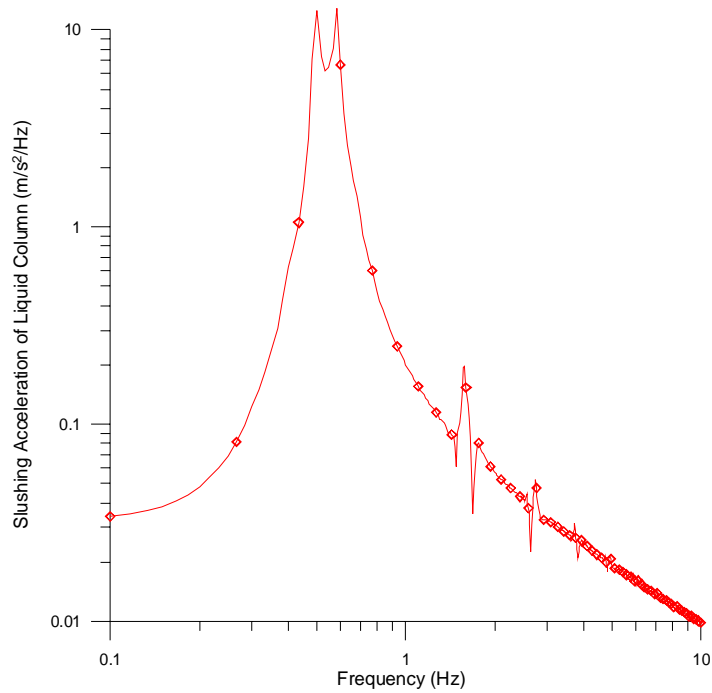


圖 3.13(a) 變斷面 VTLCD 系統水柱激盪加速度富氏頻譜圖(自由振動,  $x_s(0) = 0.1\text{m}$ ,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.45$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

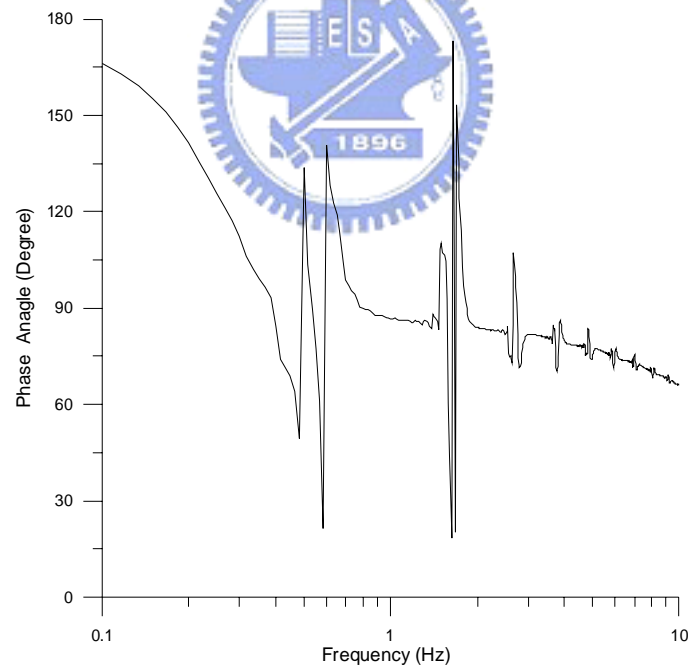


圖 3.13(b) 變斷面 VTLCD 系統水柱激盪加速度反應富氏頻譜之相位角(自由振動,  $x_s(0) = 0.1\text{m}$ ,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.45$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

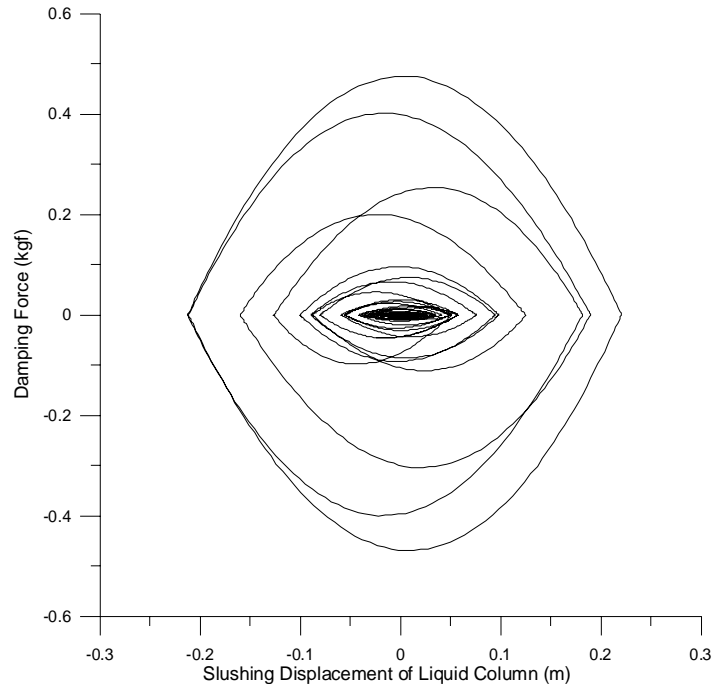
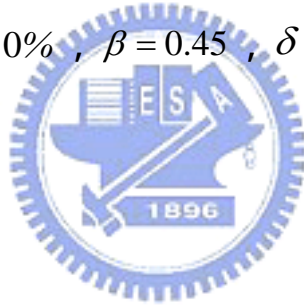


圖 3.14 變斷面 VTLCD 系統之遲滯迴圈(自由振動,  $x_s(0) = 0.1\text{m}$ ,  
 $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.45$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )



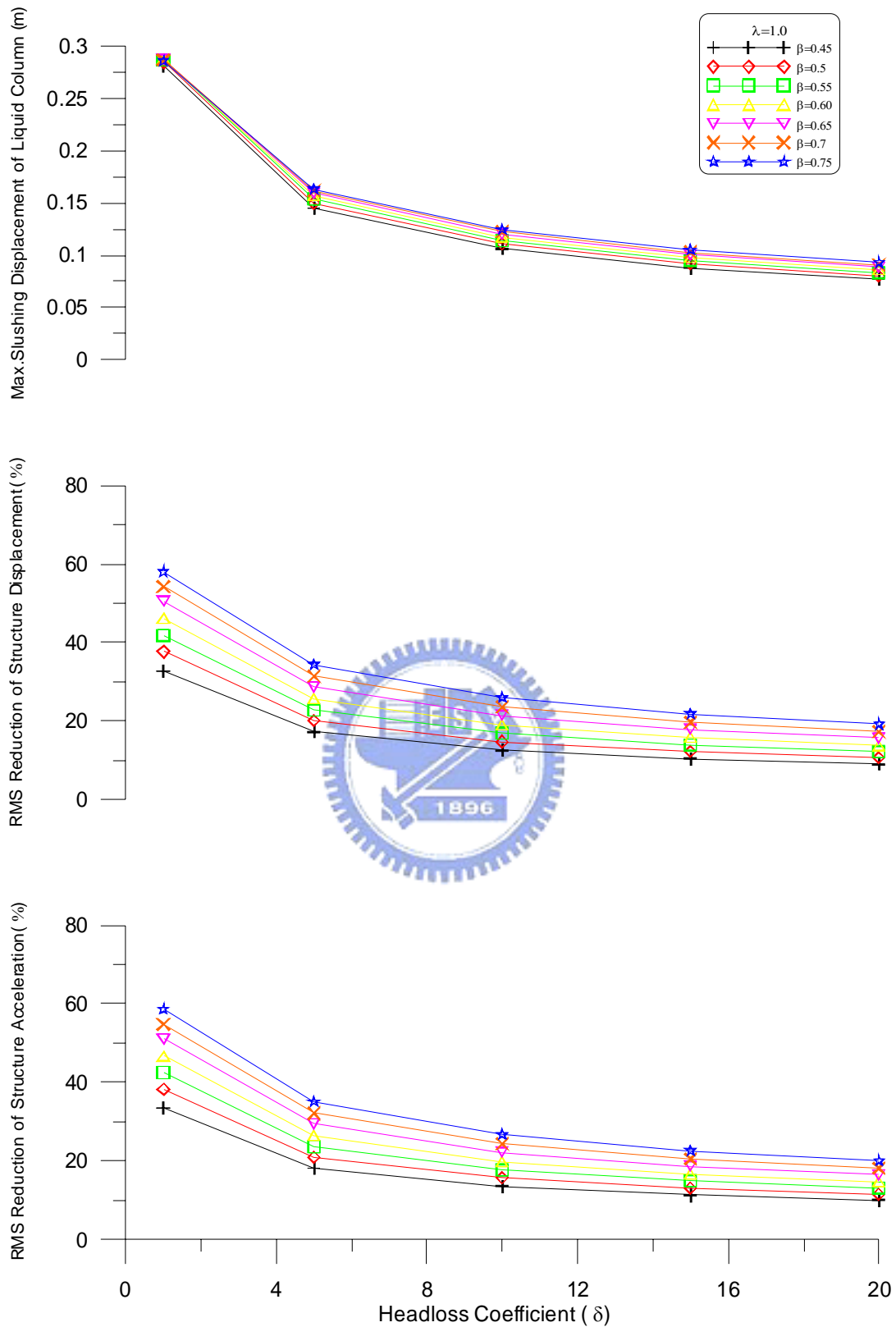


圖 3.15(a) 水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(共振簡諧擾動,  $\gamma = 1$ ,  $\zeta = 1\%$ ,  $\lambda = 1.0$ )



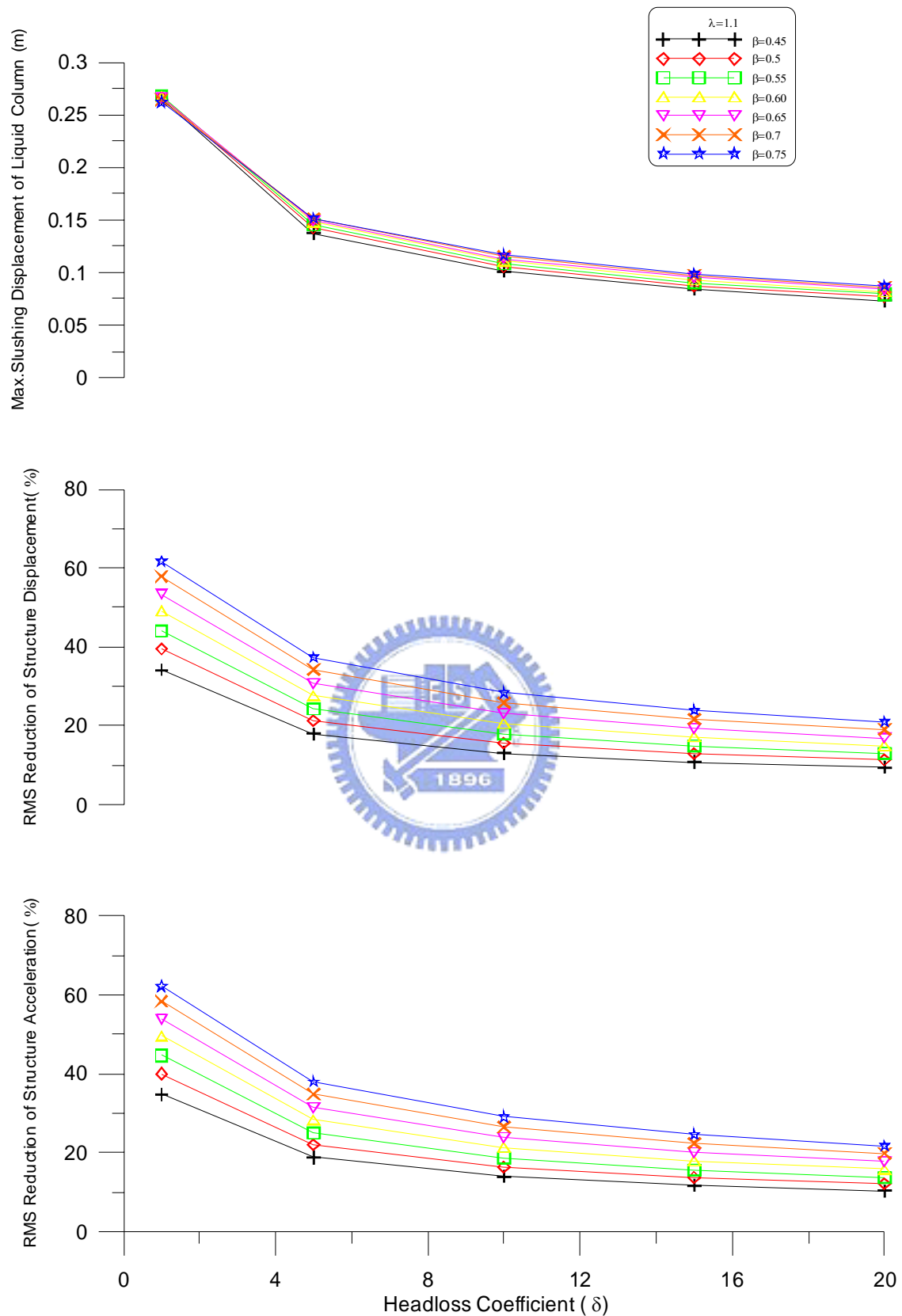


圖 3.15(b) 水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(共振簡諧擾動,  $\gamma = 1$ ,  $\zeta = 1\%$ ,  $\lambda = 1.1$ )

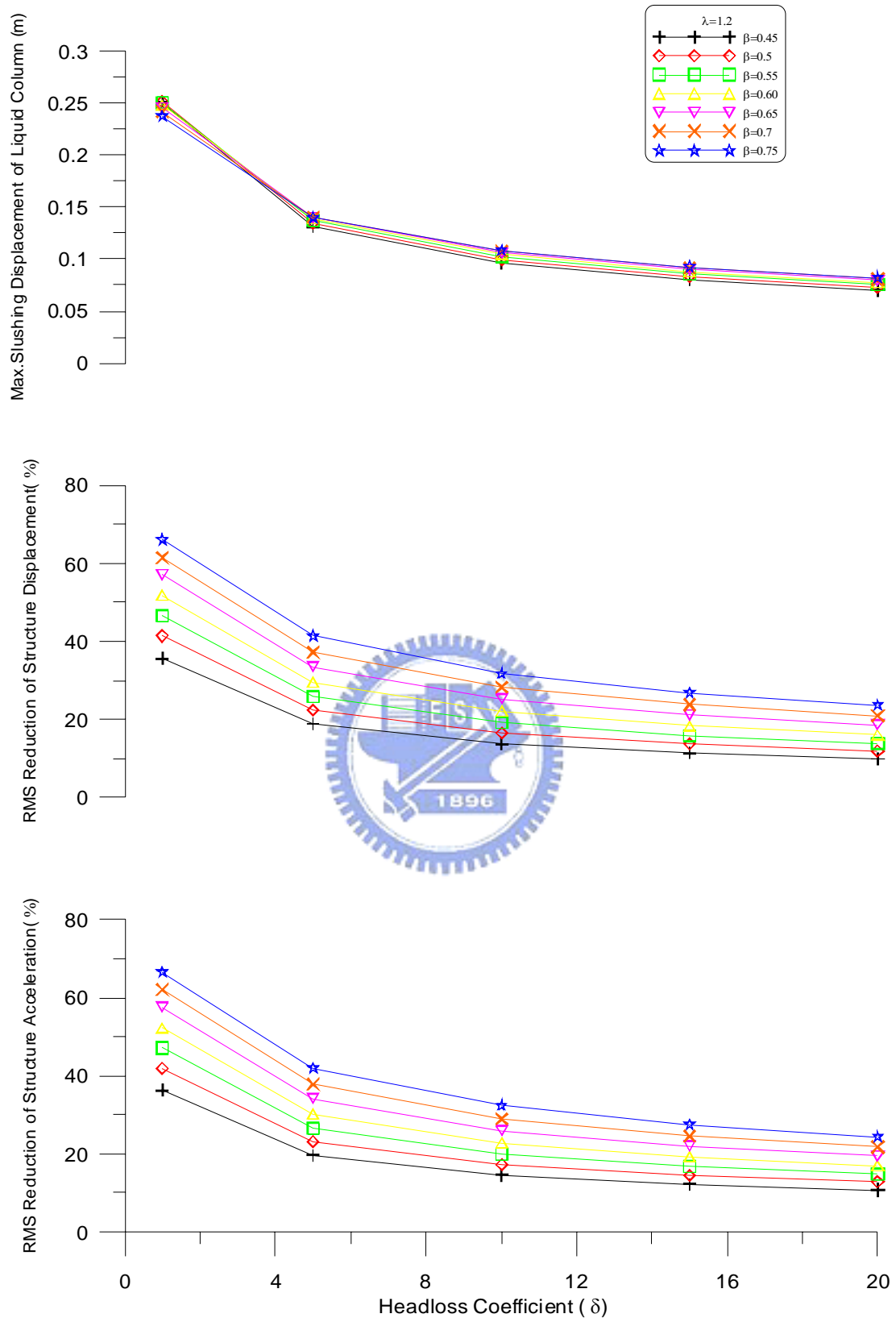


圖 3.15(c) 水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(共振簡諧擾動,  $\gamma = 1$ ,  $\zeta = 1\%$ ,  $\lambda = 1.2$ )

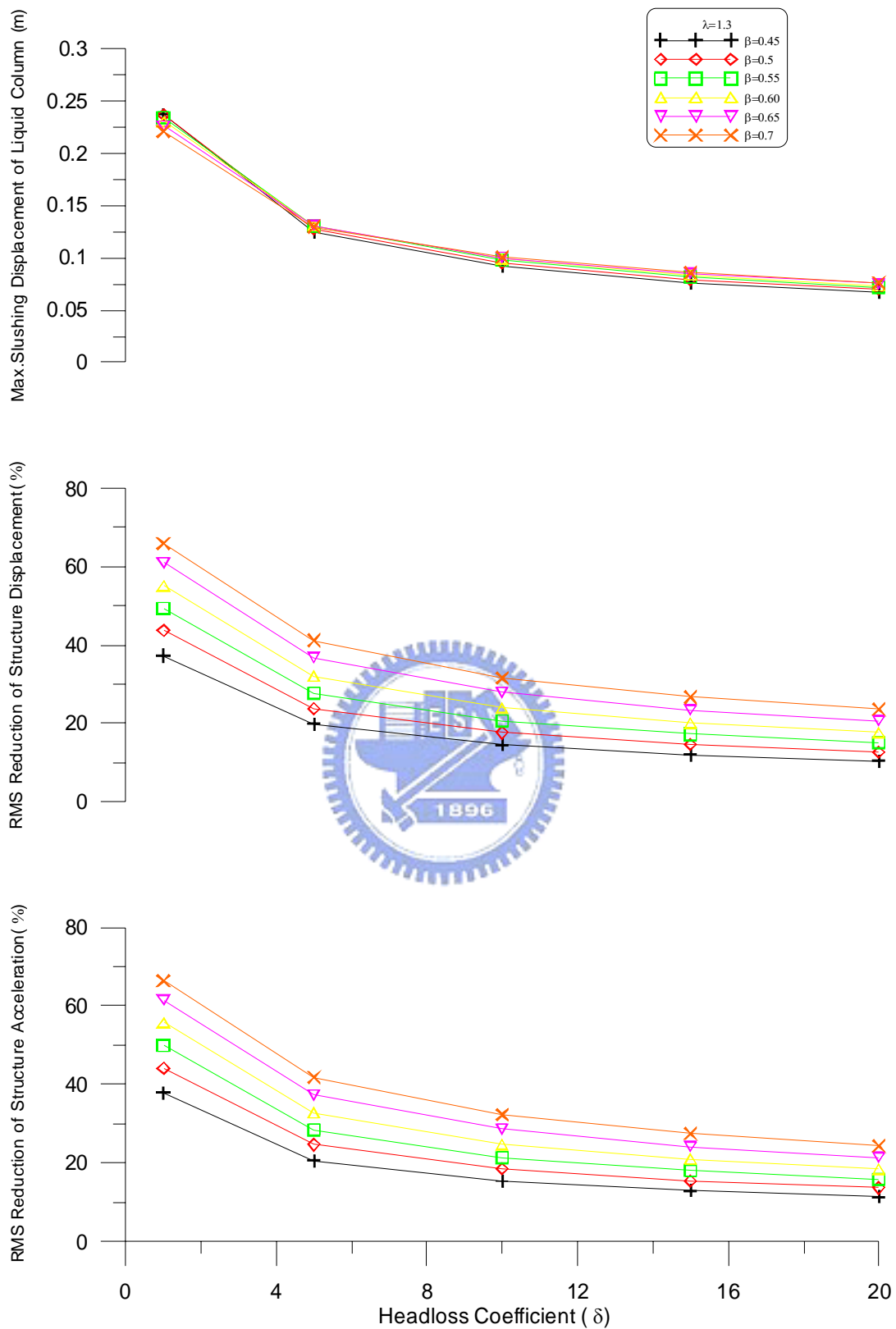


圖 3.15(d) 水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(共振簡諧擾動,  $\gamma = 1$ ,  $\zeta = 1\%$ ,  $\lambda = 1.3$ )

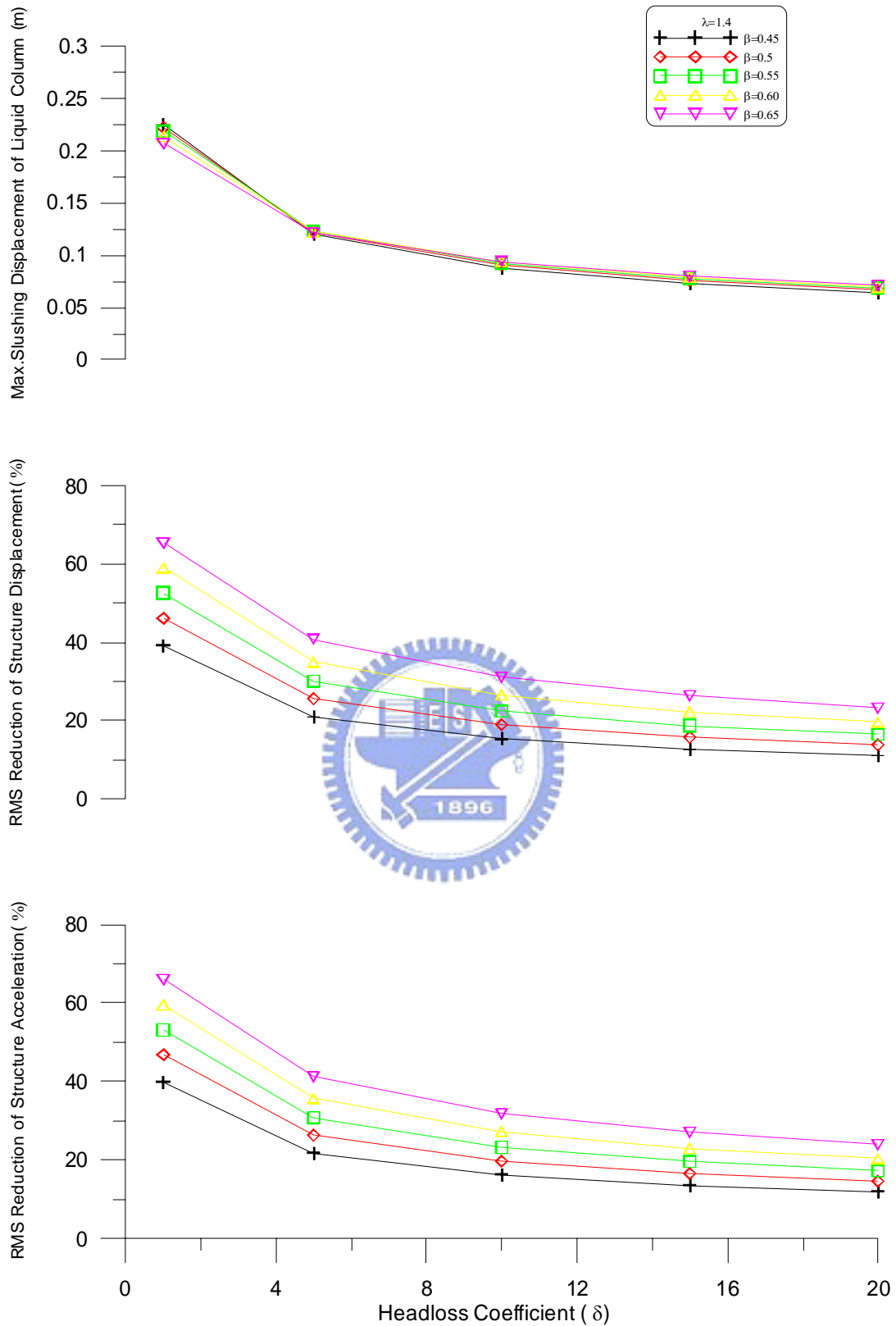


圖 3.15(e) 水平長度比與水頭損失係數對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(共振簡諧擾動,  $\gamma = 1$ ,  $\zeta = 1\%$ ,  $\lambda = 1.4$ )

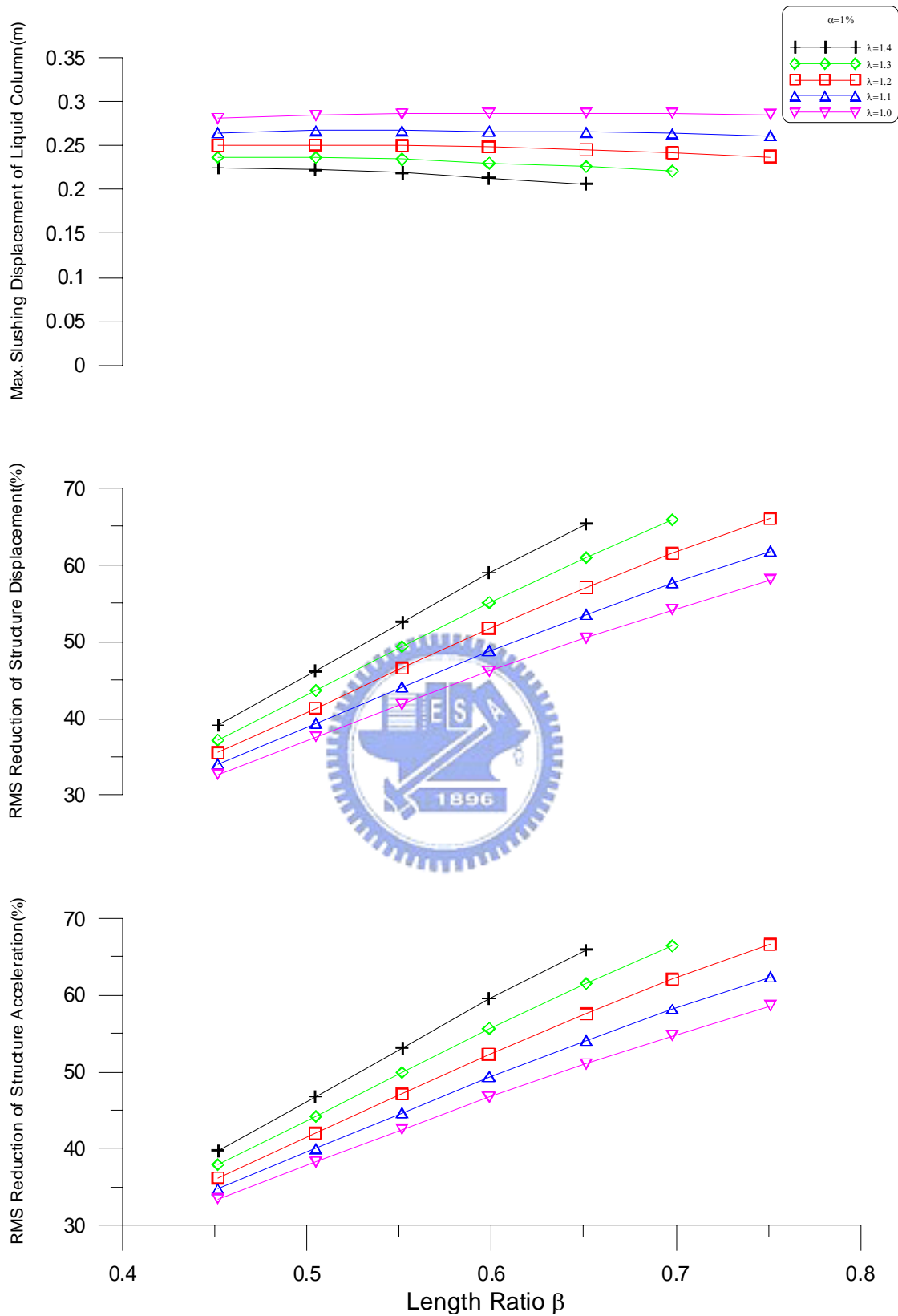


圖 3.16(a) 截面積比與水平長度比對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(共振簡諧擾動,  $\gamma=1$ ,  $\lambda=1.0$ ,  $\alpha=1\%$ )

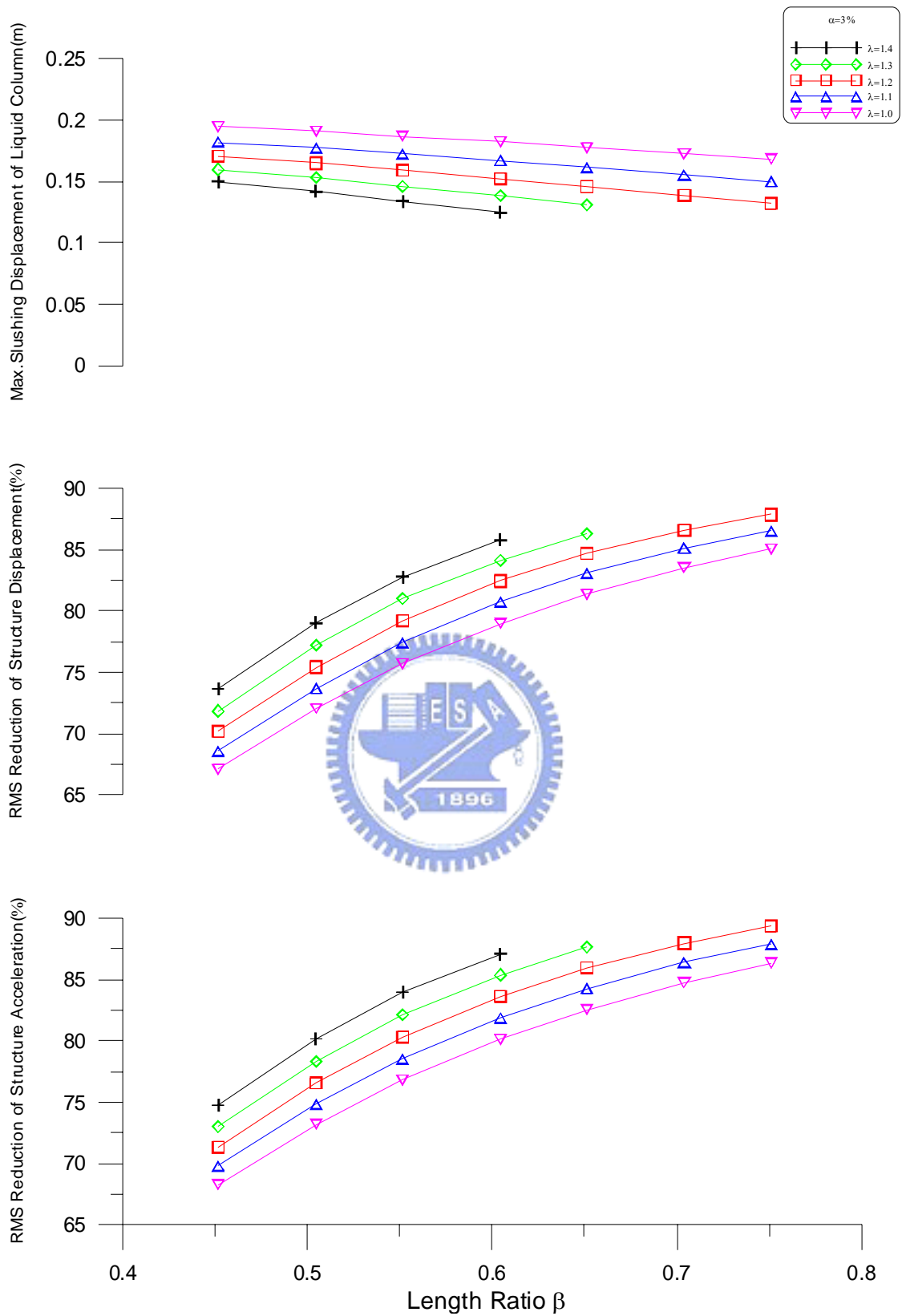


圖 3.16(b) 截面積比與水平長度比對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(共振簡諧擾動,  $\gamma=1$ ,  $\lambda=1.0$ ,  $\alpha=3\%$ )

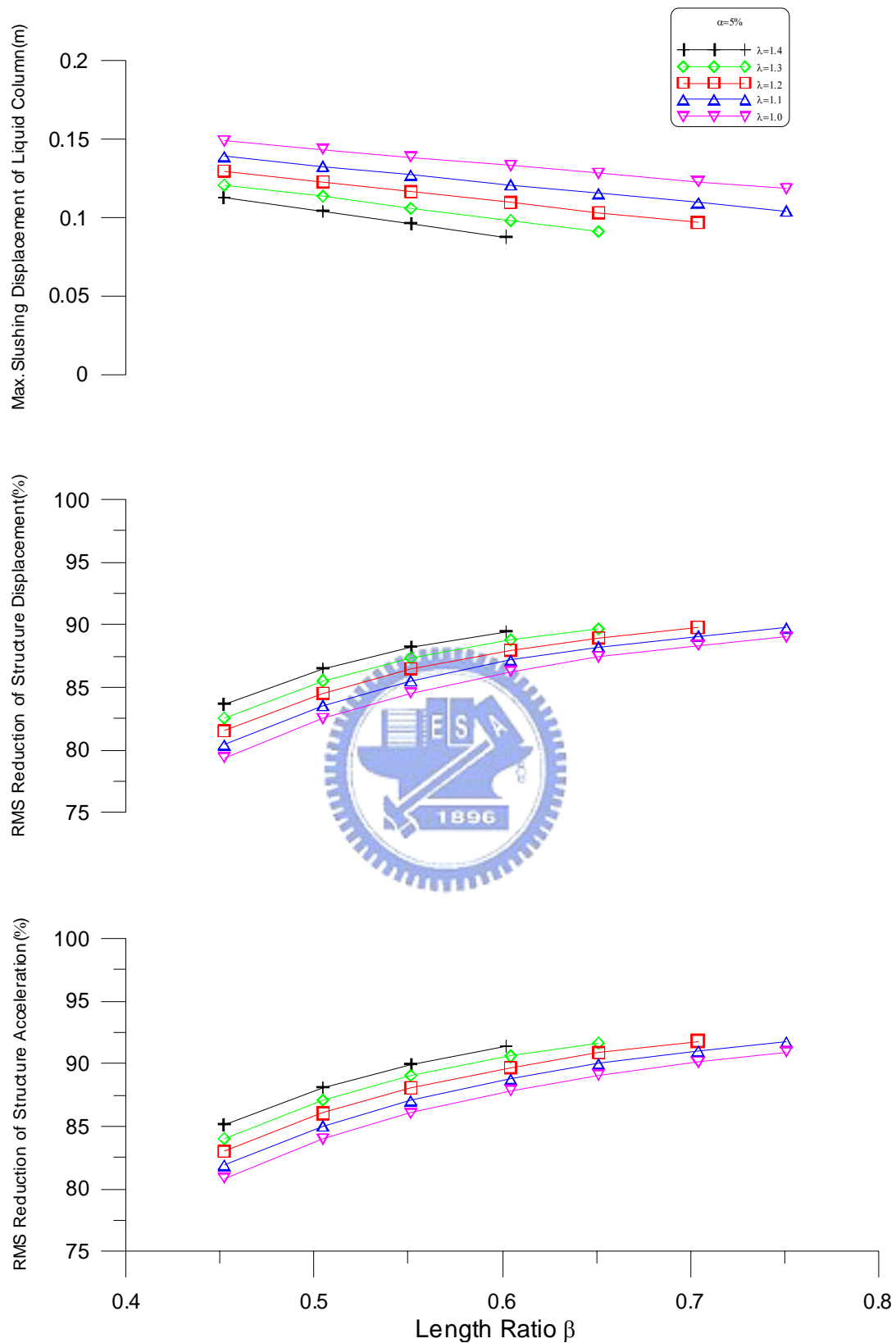


圖 3.16(c) 截面積比與水平長度比對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(共振簡諧擾動,  $\gamma=1$ ,  $\lambda=1.0$ ,  $\alpha=5\%$ )

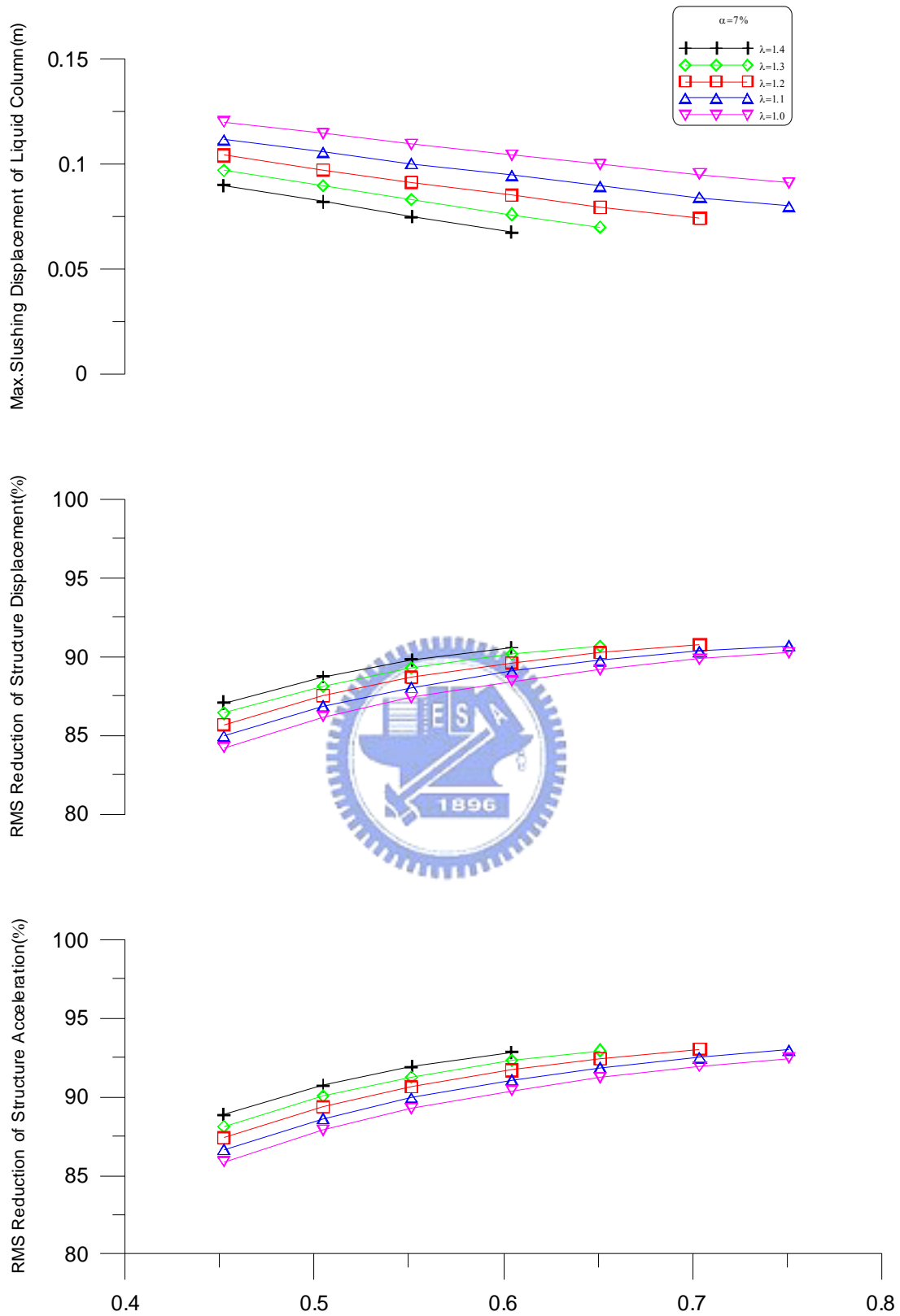


圖 3.16(d) 截面積比與水平長度比對 VTLCD 水柱激盪位移峰值及結構反應均方根折減之影響(共振簡諧擾動,  $\gamma = 1$ ,  $\lambda = 1.0$ ,  $\alpha = 7\%$ )



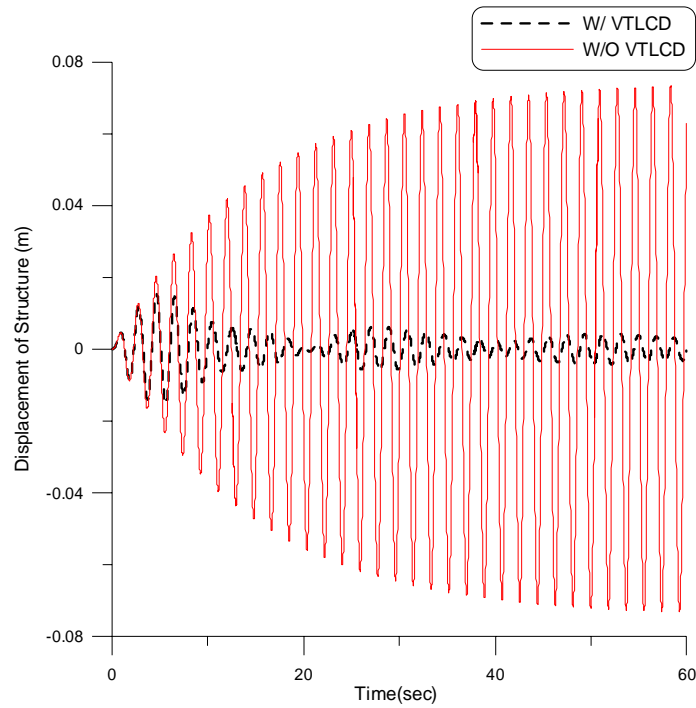


圖 3.17 VTLCD 系統控制與未控制結構之位移歷時比較(共振簡諧擾動,  $\gamma=1$ ,  $\alpha=5.0\%$ ,  $\beta=0.5$ ,  $\delta=1$ ,  $\lambda=1.4$ )

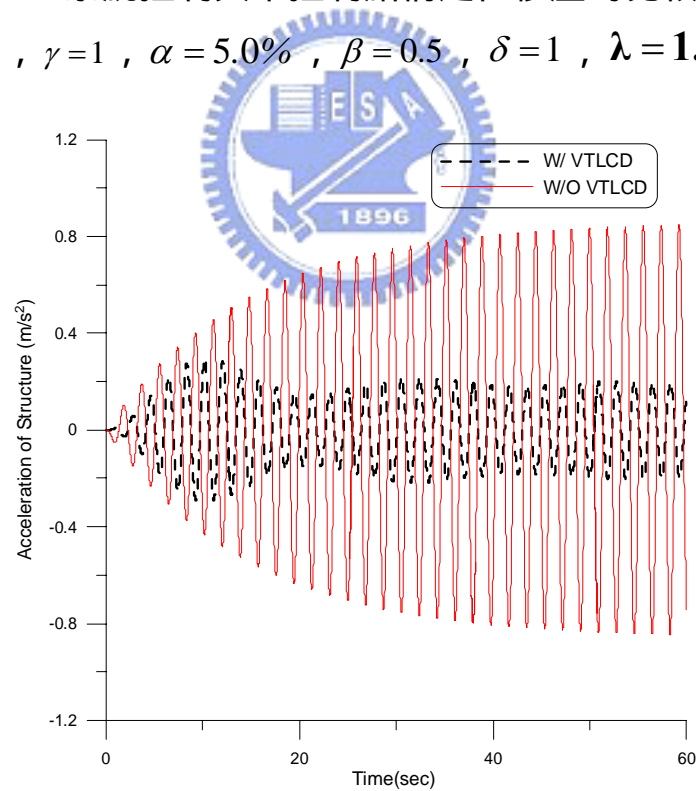


圖 3.18 VTLCD 系統控制與未控制結構之加速度歷時比較(共振簡諧擾動,  $\gamma=1$ ,  $\alpha=5.0\%$ ,  $\beta=0.5$ ,  $\delta=1$ ,  $\lambda=1.4$ )

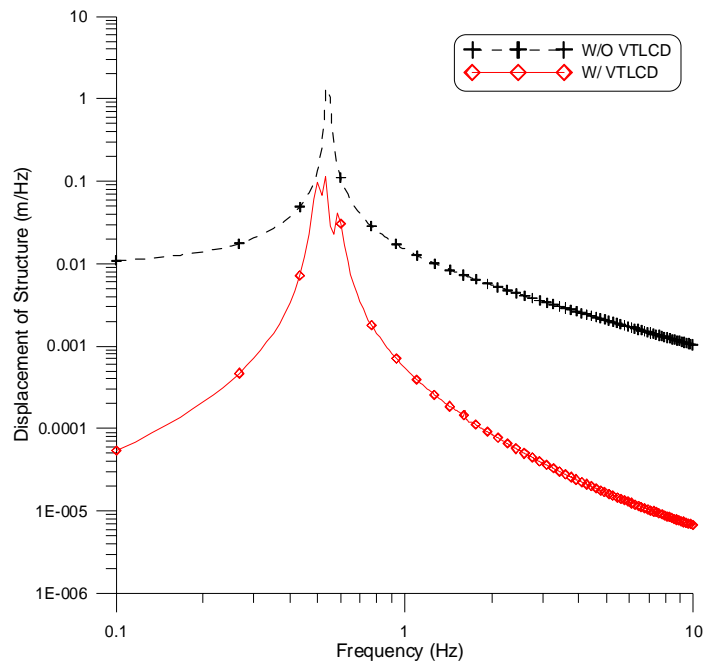


圖 3.19 VTLCD 系統控制與未控制結構之位移富氏頻譜圖(共振簡諧擾動,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.5$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

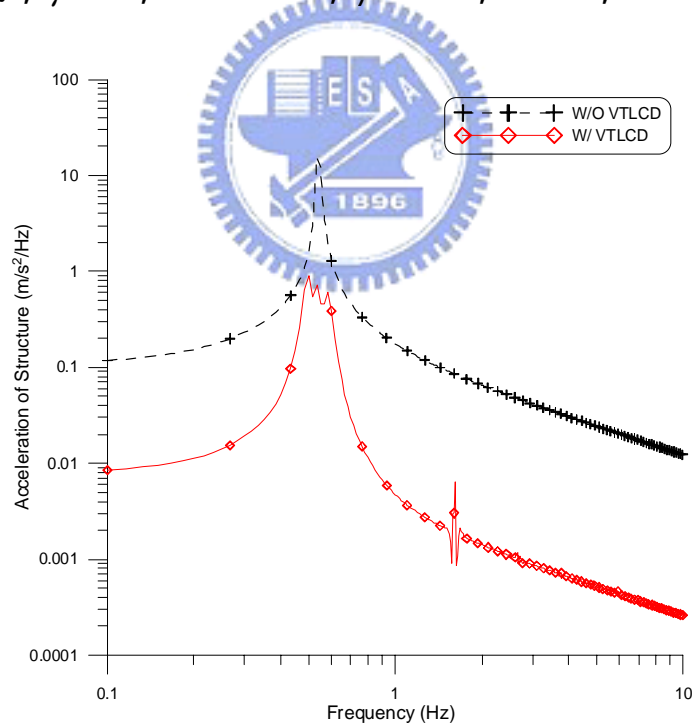


圖 3.20 VTLCD 系統控制與未控制結構之加速度富氏頻譜圖(共振簡諧擾動,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.5$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

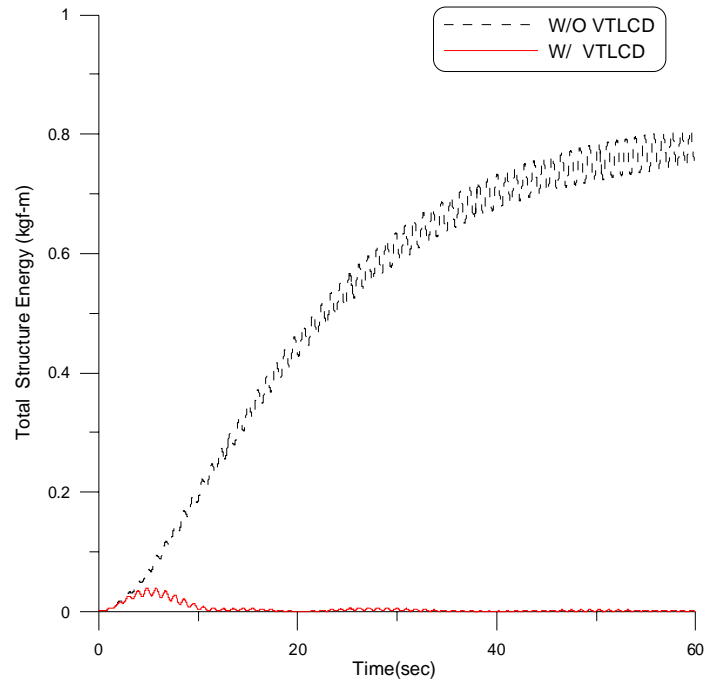


圖 3.21 VTLCD 系統控制與未控制結構之瞬時能量圖(共振簡諧擾動,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.5$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

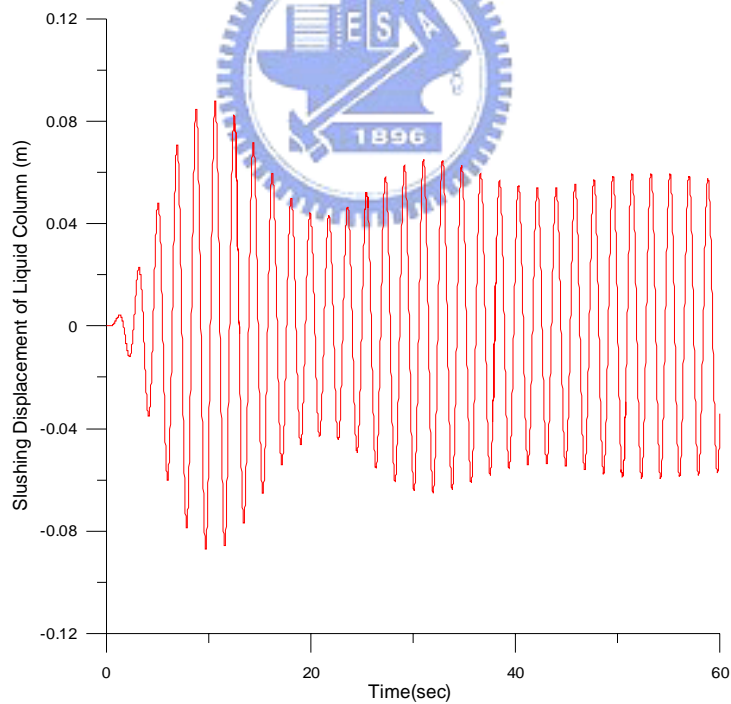


圖 3.22 變斷面 VTLCD 系統水柱激盪位移歷時(共振簡諧擾動,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.5$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

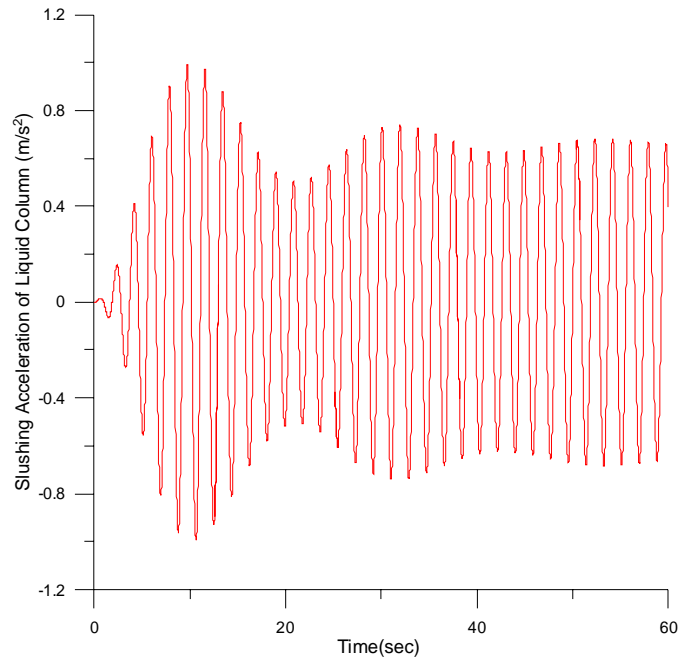


圖 3.23 變斷面 VTLCD 系統水柱激盪加速度歷時(共振簡諧擾動 ,  
 $\gamma = 1$  ,  $\alpha = 5.0\%$  ,  $\beta = 0.5$  ,  $\delta = 1$  ,  $\lambda = 1.4$ )



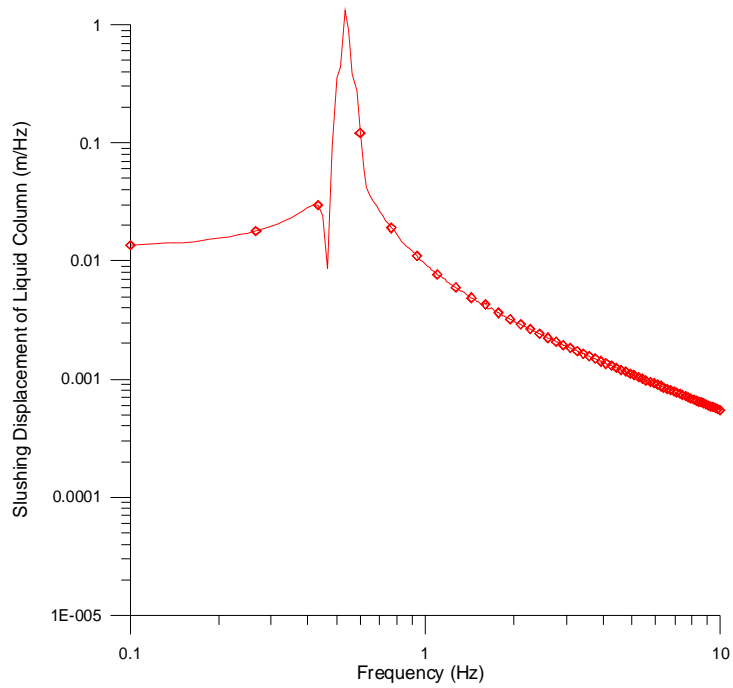


圖 3.24(a) 變斷面 VTLCD 系統水柱激盪位移富氏頻譜圖(共振簡諧擾動,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.5$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

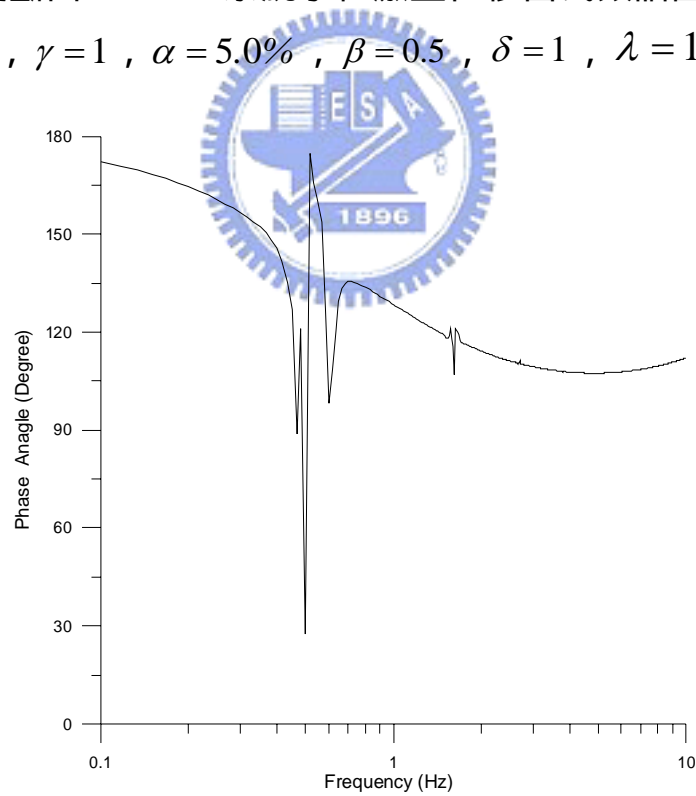


圖 3.24(b) 變斷面 VTLCD 系統之水柱激盪位移反應富氏頻譜之相位角(共振簡諧擾動,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.5$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

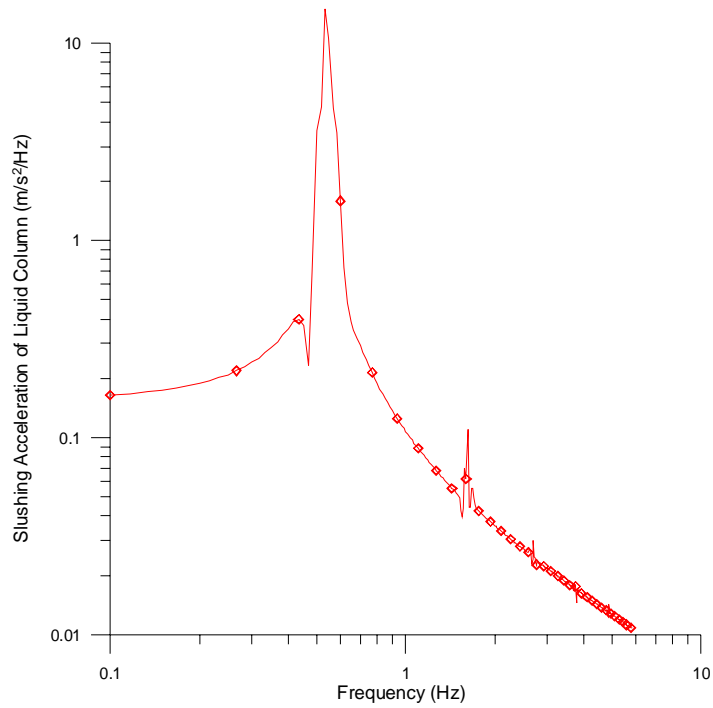


圖 3.25(a) 變斷面 VTLCD 系統水柱激盪加速度富氏頻譜圖(共振簡諧擾動,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.5$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

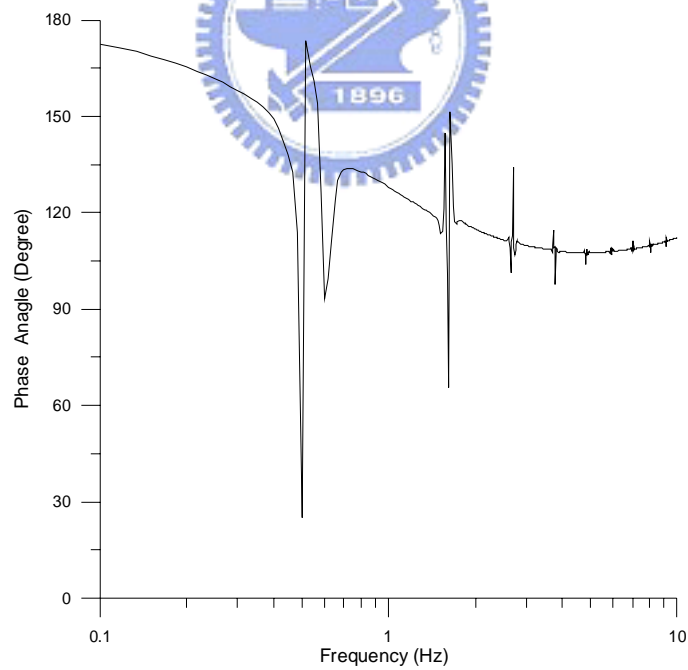


圖 3.25(b) 變斷面 VTLCD 系統水柱激盪加速度反應富氏頻譜之相位角(共振簡諧擾動,  $\gamma = 1$ ,  $\alpha = 5.0\%$ ,  $\beta = 0.5$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

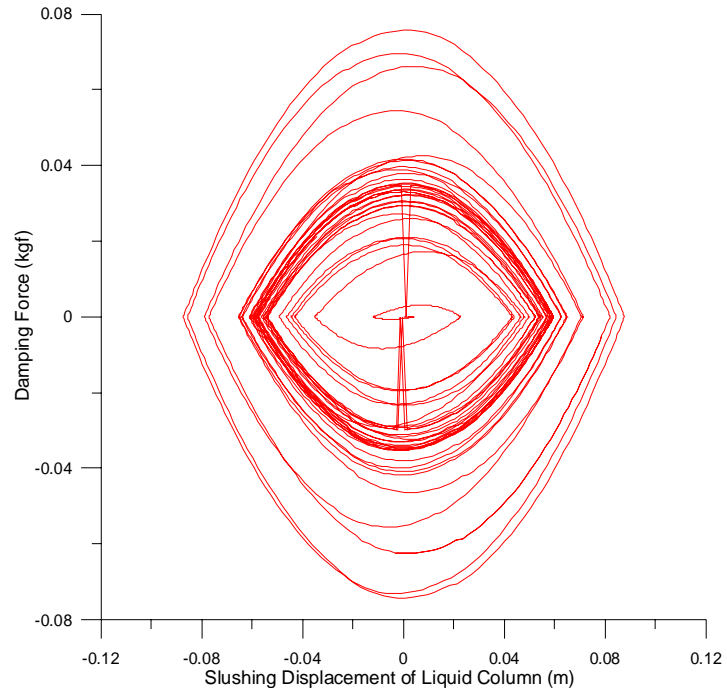


圖 3.26 變斷面 VTLCD 系統之遲滯迴圈(共振簡諧擾動,  $\gamma = 1$ ,  
 $\alpha = 5.0\%$ ,  $\beta = 0.5$ ,  $\delta = 1$ ,  $\lambda = 1.4$ )

