Passive Structural Control (HW 7)

Due: 6/6

You are required to describe the modeling procedure and discussion.

1. **Design of isolation system**

(*For saving your time, you can only consider long direction of the model for following problems.*)

Please design isolation systems with LRBs for the model you build in HW 1, with the attached two earthquake records (921CHY054-N, I-ELC270) for demands, by considering the following situations, as

i. The period of isolated structure is equal to 1 sec.

ii. The period of isolated structure is equal to 2.5 sec.

iii. The period of isolated structure is equal to 3.5 sec.

(a) Please normalize these two records with PGA equal to 320 *gal* first and draw the acceleration and displace response spectrums. Base on the three situations, please decide the **effect stiffness** K_{eff} and **damping ratio** ξ_d for isolation systems, and **yielding force** F_y and **characteristic strength** Q_d for single LRB with post yielding ratio equal to 0.1. Compare the responses of these three situations in the point view of acceleration response spectrum and displacement response spectrum and try to make a brief conclusion.

(b) Assume the design purpose is to keep the upper structure in elastic. On the other words, you have to let the drift ratio less than a specific criteria, say 0.5 % for this problem. If there is on restrict to the isolation displacement, please design the reasonable **design period** T_e, K_{eff}, and ξ_d, and F_y and Q_d for single

LRB with post yielding ratio equal to 0.1. Use time history analysis to verify your design and draw the acceleration responses of top flood and displacement responses of isolation layer for both isolated structure and bare frame, and comparing the maximum drift ratio for both isolated structure and bare frame. Finally, draw the hysteresis loop of LRB. (hint: you may design the isolation system by referring to the results of the problem (a), but do not use the same design period in problem (a).)

(c) Receiving from problem (b), if the isolation displacement is restrict to only 4 *cm* at the base, you may use viscous dampers, with α equal to 1.0, to reduce the isolation displacement responses. Please design the damping ratio provided from viscous dampers and the coefficient C of viscous dampers. Similarly, use time history analysis to verify your design and draw the acceleration responses of top flood and displacement responses of isolation layer for both isolated structure and bare frame, and comparing the maximum drift ratio for both isolated structure and bare frame. Finally, draw the hysteresis loop of LRB and viscous damper.

(d) Is the damping ratio provided from viscous dampers or the restriction to isolation displacement reasonable? If you think the damping ratio is too high or it is impossible to reduce the isolation displacement to 4 *cm* at the base, what can you do to modify this situation?

2. Reading Assignment

"Simplified analysis of mid-story seismically isolated buildings"

Please type one page of what you've learned from this paper.