# Passive Structural Control (HW 6)

You are required to describe the modeling procedure and discussion.

1. **Modal Strain Energy Method:**

   Consider a three story shear frame as follow. The floors are assumed to be rigid. And the columns are assumed to be massless. The mass of each floor is 10 ton. Note that we install viscous damper every story as the figure says. Each story is installed with a viscous damper to provide **at least 15% additional damping ratio at 1% story drift**.
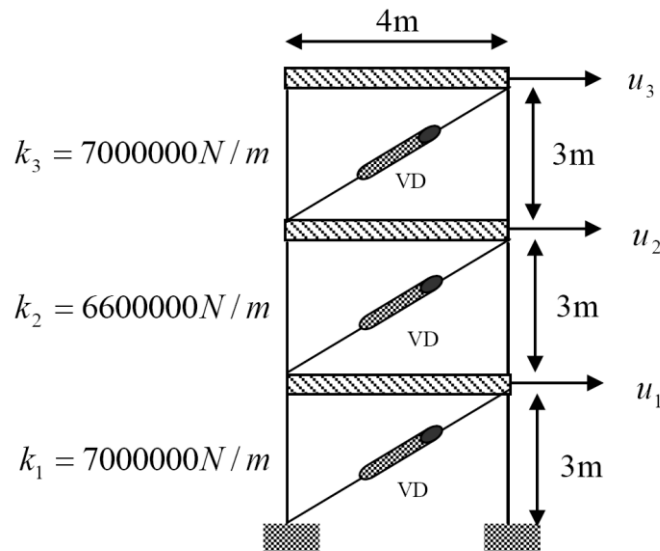

   Assume that the brace is much more stiffness than that of the damper, please determine damping coefficient(C) and maximum damper force (F_D) in the following cases.

   (1) Linear viscous damper.

   (2) Nonlinear viscous damper with α=0.3

   (3) Nonlinear viscous damper with α=0.7

2. **Design Viscous Damper**

   Please devise viscous dampers with 17% damping ratio (2% inherent damping of the steel frame + 15% viscous dampers provided) for designing the structure which you built in HW#1. Note that you have to install your dampers in the gray-hatching zone by using brace type or K-brace type.

   Elevation Frame 1, 3   Elevation Frame 2
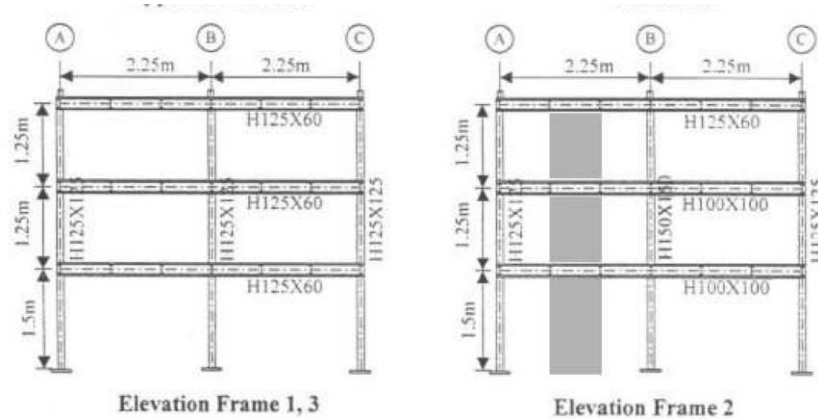
Period(sec)	1st mode	2nd mode	3rd mode
Bare frame	____	____	____
Bare frame with VD	____	____	____

   (1) Scale time history records El Centro and TCU068 (attached) to PGA=0.33g and use it for time history analysis. Plot the time history of the displacement and acceleration at roof for structure with and without damper.

   (2) Fill out your modeling output data as following table (absolute maximum). Compare the absolute maximum of floor displacement and story drift for comparison and make discussion on the result.

   Please make sure your DESIGN is reasonable and feasible.

Floor	Bare				Bare+VD				Ratio of Responses		
	(1)	(2)	(3)		(4)	(5)	(6)		(4)/(1)	(5)/(2)	(6)/(3)
	Dis.	Vel.	Acc.	Inter story drift	Dis.	Vel.	Acc.	Inter story drift	Dis.	Vel.	Acc.
	cm	cm/s	gal	%	cm	cm/s	gal	%	Ratio	Ratio	Ratio
3											
2											
1											

(The table header "Name of Ground Motion" spans the full width above.)

3. Reading Assignment

"Comparative Study of Frames Using Viscoelastic and Viscous Dampers"

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