

Passive Structural Control (HW 6)

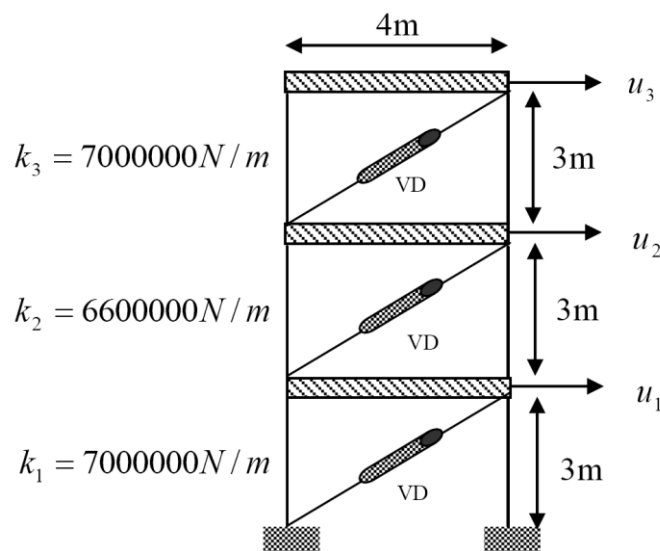
Due: 5/23

You are required to describe the procedure and discussion.

1. Identify viscous damper's coefficients C and α

Please identify the damping coefficient C (including the unit) and non-linear coefficient α of the damper's mechanical formula: $F = CV^\alpha$ from the attached VD tests data. Please show the nonlinear regression curve, test data, and $\pm 15\%$ error curves.

2. Consider a three stories 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 12 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**.

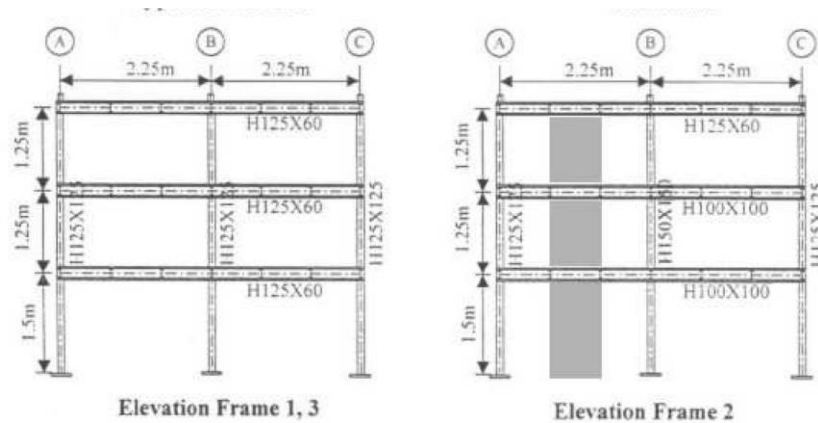


Assume that the brace is much more stiffness than that of the damper, please determine damping coefficient(C) and maximum damper force (F_D) in the following cases.

- (1) Linear viscous damper.
- (2) Nonlinear viscous damper with $\alpha=0.3$
- (3) Nonlinear viscous damper with $\alpha=0.7$

3. Design Viscous Damper

Please devise viscous dampers with 20% damping ratio (2% inherent damping of the steel frame + 18% viscous dampers provided) for designing the structure 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.



Period(sec)	1 st mode	2 nd mode	3 rd mode
Bare frame	_____	_____	_____
Bare frame with VD	_____	_____	_____

- (1) Scale time history records El Centro and TCU068 (attached) to $PGA=0.32g$ 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.

Name of Ground Motion											
Floor	Bare frame				Bare frame +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											

4. Reading Assignment

“Comparative Study of Frames Using Viscoelastic and Viscous Dampers”

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