

**CIVL7119/8119**  
**Homework Set 6**

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**DESIGN FOR DYNAMIC LOADS**

The intent of the following problems is to review some concepts related to dynamic analysis and to assess their applicability to design. Perform all your analyses and calculations **by hand, spreadsheet, Mathcad** then use **SAP2000** to solve the same problem.

1. Consider the three-story frame structure shown below. We are to do a preliminary design for serviceability based on UBC spectrum scaled to 0.15g peak ground acceleration (see attached for Soil Type 2). Use elastic analysis methods, modal superposition techniques and 5% viscous damping in the following calculations and discussions. **Tabulate your results.**

- a. Compute the story shears, floor level displacements and overturning moments at floor levels. Use SRSS, CQC, or sum of the absolute modal responses as you see fit for as many modes as needed.
- b. Justify the solution method used in (a), clearly indicating how one should combine modes for this type of system and how to select the number of modes.
- c. Compute the expected interstory drifts that you would expect in the second story.
- d. Compute the expected maximum acceleration at the roof (for design of mechanical equipment).
- e. Based on your answer to parts (a), (c) and (d) comment on how various modes contribute to different response quantities. In particular,
  1. do you need the smaller number of modes to get displacements, shear, accelerations and drifts?
  2. Does this depend on the location in the building?
  - 3.. How is this conclusion affected by the fundamental frequency of the structure (i.e., would you expect that these calculations would change if the fundamental period was 0.3 sec.) (do not calculate for this; just make a qualitative observation on the basis of your numbers and shape of the response spectrum).

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