

# Dynamic Analysis of MDOF Systems

*Assuming we are going to do a static pushover analysis or a nonlinear dynamic time history analysis*

- *Modeling Basics*
- *Examples of Pushover and Dynamic Analysis Results*
- *Useful MDOF concepts*
  - *Drift Spectrum*
- *Analysis Issues*
  - *Design: Dynamic Capacity Design*
  - *Capacity: Incremental Dynamic Analysis*
  - *Demand: Fragility Curves*
- *Detailed Modeling Issues*
  - *Damping*
  - *Soil-Structure Interaction*
- *Interpretation Issues*
- *Probabilistic assessment of achieving performance goals (later)*
- *Design to control motion*

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# References

There are many detailed papers on modeling and dynamic response

- FEMA 356 (ASCE 41)
- Chopra, *Dynamics of Structures*, 3rd Ed, 2006
- *Steel Moment Frame Structures*
  - FEMA 350 to 352 and FEMA 355 C & F
- *Steel Braced Frame Structures* - see class notes
- *Reinforced Concrete*
  - Haselton, C.B. and G.G. Deierlein, 2006. *Toward the Codification of Modeling Provisions for Simulating Structural Collapse*, 8<sup>th</sup> National Conference on Earthquake Engineering (100<sup>th</sup> Anniversary Earthquake Conference), San Francisco, California, April 18-22, 2006, 10 pp.
  - <http://www.stanford.edu/~haselton/Publications.htm>
- *Drift Spectrum*
  - Iwan, W., *Drift Spectra: Measure of Demand for Earthquake Ground Motion*, J. of Structural Division, ASCE, 1997.
- *Soil structure interaction*
  - Kramer, S. *Geotechnical Earthquake Engineering*, Prentice Hall, 1996.
  - FEMA 356

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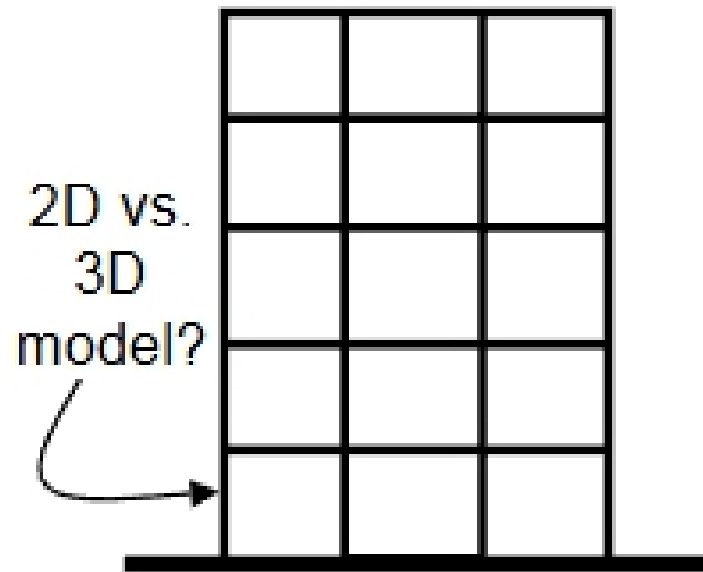
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# Modeling Basics



## Modeling Parameters:

- ❖ Geometry
- ❖ Mass
- ❖ Stiffness, strength and hysteretic characteristics of:
  - ✓ Members and connections
    - *Lateral load resisting system*
    - *Gravity load resisting system*
  - ✓ Foundations
  - ✓ Diaphragms, Collectors, Drag struts
  - ✓ Soil-foundation system
  - ✓ Nonstructural components
- ❖ Damping
- ❖ Geometric nonlinearities

