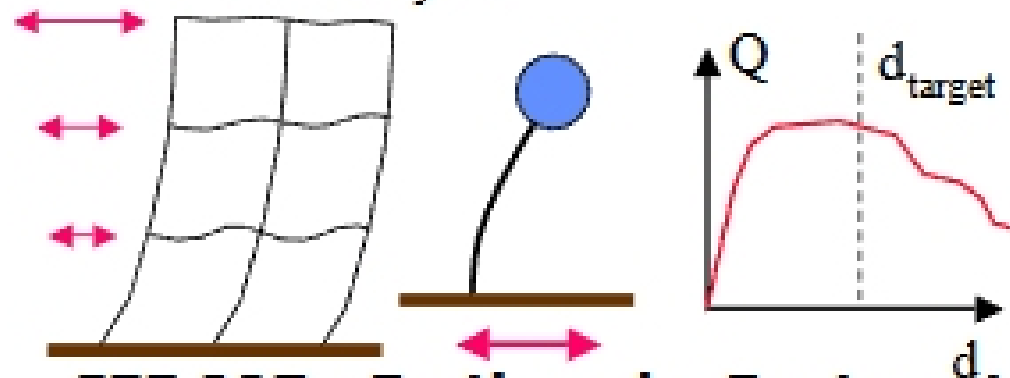


Use of Inelastic Response Spectra in Design of MDOF Systems

a. Reduce MDOF system to equivalent SDOF system

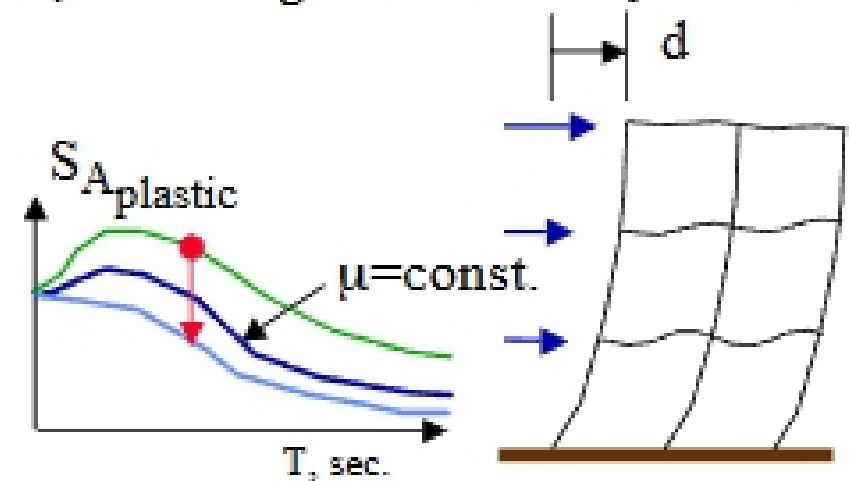
→ Simplified inelastic dynamic analysis to determine sensitivity to ground motion and structural characteristics

→ Determine target displacement for static push-over analysis



b. Extrapolate SDOF response spectrum concepts to MDOF inelastic systems

→ Determine design forces, drifts, displacements, etc. for proportioning of MDOF system



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Earthquake-Resistant Design of Multiple Degree of Freedom Systems

Roadmap

- *Theoretical Foundations*
 - *Elastic Systems - Review*
 - *Inelastic Systems*
 - General Concepts
 - Code Approaches
 - Special issues - Pushover analyses
- *Mechanical Modeling Issues*
- *Examples of behavior*
 - *Higher mode contributions*
 - *Expected response of various systems*
- *Design for motion control*
 - *Moment Frames, Braced Frames, Isolated systems*
 - *Force, acceleration, drift*

Supplemental Reading

- *Dynamics of Structures (Chopra):*
 - Ch. 19 (3rd Edition) - See class web site.
 - Ch. 18 (2nd or 3rd Edition)
- *FEMA 356 (Section 3.3 and 3.4, skim remainder of Ch. 3)*
- *FEMA 355C and 355F*
- *Various papers posted on web site*

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Some Applications & References

Several guidelines and research studies have developed procedures for PBE evaluation based on these concepts:

- *Building Seismic Safety Council, "Guidelines for Seismic Rehabilitation of Buildings," FEMA 356, Washington DC, 2003*
- *Miranda, E., "Estimation of Maximum Interstory Drift Demands in Displacement-based Design," Seismic Design Methodologies for Next Generation of Codes, Balkema, Rotterdam, 1997.*
- *Seneviratna, G., "Evaluation of Inelastic MDOF Effects for Seismic Design," Ph.D. Dissertation, Department of Civil Engineering, Stanford University, 1995.*
- *Song, J-K and Pincheira, J., "Spectral Displacement Demands of Stiffness- and Strength-Degrading Systems," Earthquake Spectra, EERI, Vol. 16, No. 4, Nov. 2000.*
- *Chopra, Anil K.; Goel, Rakesh K., "A modal pushover analysis procedure for estimating seismic demands for building, Earthquake Engineering & Structural Dynamics, 31, 3, Mar. 2002*

