

Things you should know for your ECIV 734 Final Exam

Most have been reformatted into questions, those that have not are, I believe, obvious. I have listed example questions at the end of each little subsection

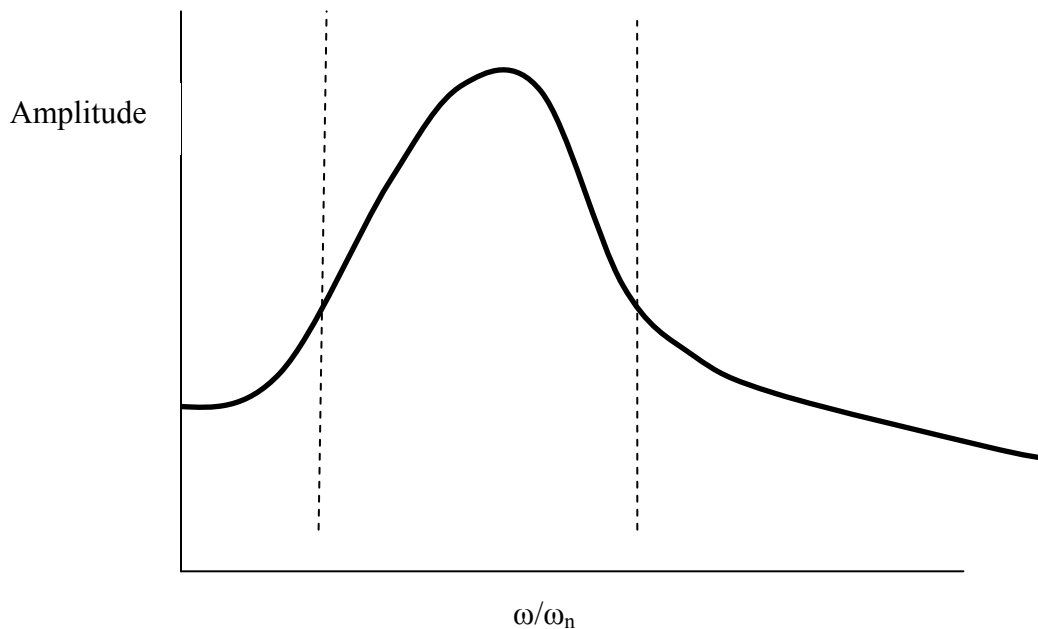
Single degree of freedom systems

Constants m, c, k used in evaluating SDOF systems

Free vs. Forced vibration systems, differences in the equation of motion

Identify the transient vs. steady state portion of forced vibration SDOF system

Q. Given the SDOF response curve (Fig 1, below), which component (m, c, k) controls the displacement (or dynamic amplification) of the system at the various frequencies of excitation



Multi Degree of Freedom

What is modal analysis

Given a “structure” with three masses, sketch the mode shapes

How does a MDOF system translate into a set of Matrix equations

Method of Complex Response

How does this method simplify our analysis of real-world problems?

What is complex modulus

What are some of the shortcomings of this approach

Duhamel Integral

What does it compute ?

Given the formula, indicate what the terms are.

Q. Duhamel can integrate either a forcing function, like $p(t)$, or an acceleration record, like $a(t)$. How can you switch from one to the other?

Discreet Fourier Transform

What is time domain and frequency domain

What is magnitude and phase vs. real and imaginary components

What is Nyquist Frequency?

Given the formula, describe the terms involved

Given a plot of Magnitude vs. Frequency, what is the dominant frequency

Q. How can we demonstrate filtering of specific frequencies in our acceleration vs. time plots, using DFT?

Tectonics

How does one describe a fault

Know the difference between transverse, normal, and thrust faults

Know the relevant parts of a subduction zone with respect to earthquakes

Q. What kind of earthquakes occur at great depths (hopefully you would answer more than “deep focus”)

Strong Motion

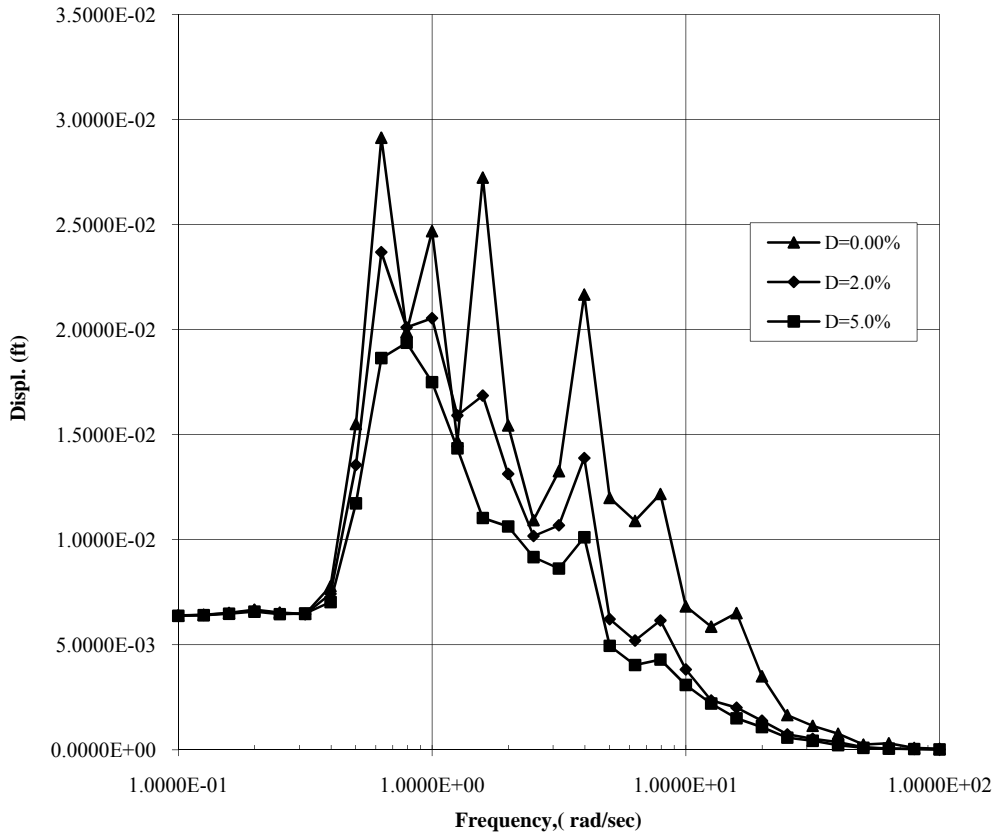
Given the acceleration record, compute velocity, displacement

Given the formula, compute power spectra

Explain how to compute elastic response spectra

Q. Given the response spectral below, and our handy dandy formula for estimating building period, what building size would you expect to be more susceptible to this particular earthquake: 6-story, 12-story, 24 story buildings?

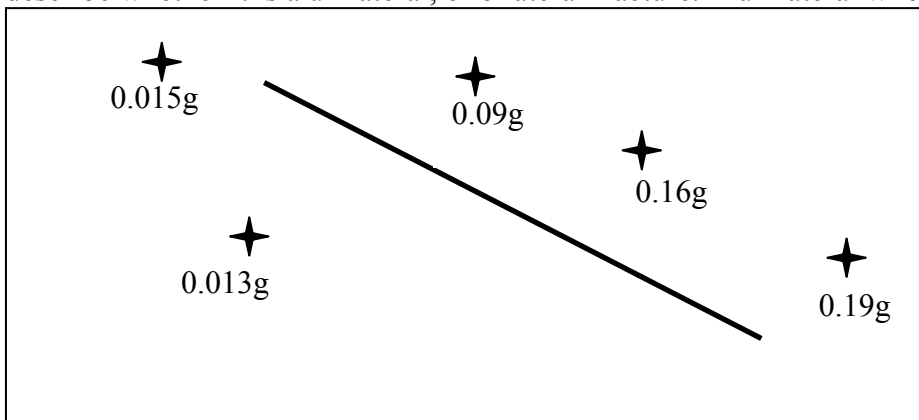
Disp. Spectra vs. Frequency



Seismic Hazard Analysis

Explain the difference between deterministic and probabilistic seismic hazard analysis
 Understand the Gutenberg-Richter recurrence laws

Q. 4. Given the peak accelerations at the different locations along the fault (Figure below.) , describe whether it is a unilateral, or bilateral fracture. If unilateral where did it start ?



Wave Travel in Elastic Continuum

Formula for p-wave and s-wave velocity, given elastic constants

Given the graph from Kramer of Rayleigh amplitude vs. depth, sketch the Rayleigh wave particle motion

1-D wave travel in rod

Know what a standing wave is for different end conditions

Given source wave, what will be reflected from fixed or free end, i.e. tension going in...tension or compression coming back

How are standing waves generated in a rod (formula?)

1-D Method of Characteristics

Linear properties

Non-linear properties and interpolation

Given the equations for C+, C- characteristic, should be able to calculate stress and velocity over time for given simple excitation and soil conditions

Dynamic Soil Properties

Factors affecting dynamic soil properties

Confining stress

Void Ratio

Stress History

Confinement history (Overconsolidation)

Immediate stress-strain history (Loading cycles)

Ideas behind Dynamic Soil Models

Elastic

Viscoelastic

Non-linear deformation

Constitutive models

Equivalent linear behavior

Tangent modulus

Secant modulus

Viscoelastic models

work/energy

elliptical s-s behavior

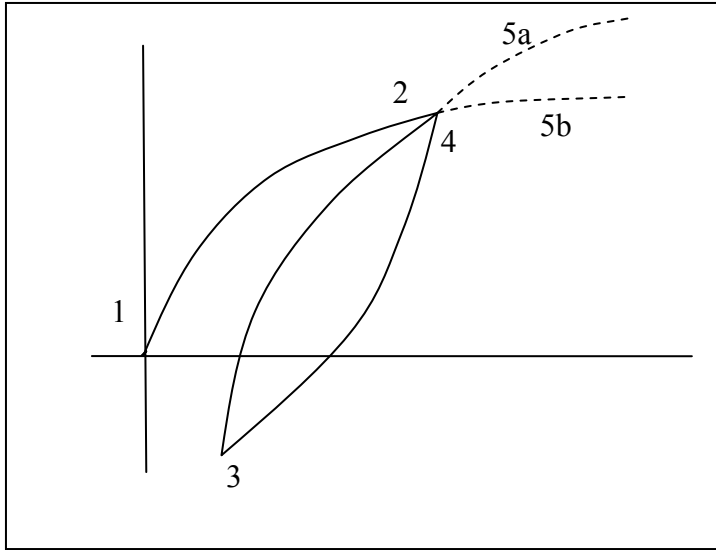
Non-linear simple deformation

Hyperbolic

Ramberg-Osgood

Extended Masing criteria

Q. Where should the SS curve follow?



- Strain softening, strain hardening
- Cyclic stress controlled vs. strain controlled
- Laboratory Testing
 - Cyclic triaxial
 - State of stress-Mohr's circle
 - Static initial loading
 - Simple shear
 - With vertical static load
 - Mohr's circle representation
 - Torsional shear
 - Mohr's circle representation

Liquefaction

- Liquefaction on level ground
 - Cyclic Loading estimates
 - Seed and Idriss simplified method, given formula, apply to a soil column
 - Cyclic resistance estimates
 - Based on SPT
 - Based on Lab testing

Slope Stability

- Pseudo-Static analysis
- Dynamic analysis (exceeding a limiting acceleration)

Code Approaches to Earthquake Engineering

- Difference between A,B,C, D,E soil profiles
- How are spectra applied
- What is the usual quantity or quantities of interest in determining severity of shaking