

# 03/31/07 CIVL-558 Earthquake And Wind Engineering - CJ Roberts

## Homework Assignment #3

3.2) A building may be assumed to have damping proportional to velocity. In a human vibration test the building is observed to complete two oscillations each second and in five oscillations its response amplitude diminishes by 50%. Calculate the damping ratio. In what proportion would the period of vibration be decreased if the damping could be removed?

find:  $\xi$                        $\xi = (1/2j) \ln(x_n/x_{n+j})$  (Logarithmic Decrement)

find: j                          j = 5 cycles (given)

find:  $x_n$                        $x_n = 1.0$  (assume any peak height)

find:  $x_{n+j}$                      $x_{n+j} = x_n/2$  (given, response amplitude 50% at 5th cycle)

$x_{n+j} = 0.5$

$\xi = 0.0221$  or 2.21% of Critical Damping

$T_d = 0.5$  seconds    Given that the damped building cycles twice every second.

Knowing:                       $T = 1/(2\pi\omega)$  and                       $\omega_d = \omega\sqrt{1-\xi^2}$

Conclude:                       $T = T_d \sqrt{1-\xi^2}$

$T/T_d = \sqrt{1-\xi^2}$

$T/T_d = 0.9998$  or 0.024% Decrease in Period