FACULTE ENVIRONNEMENT NATUREL, ARCHITECTURAL ET CONSTRUIT ENAC
INSTITUT D'INGÉNIERIE CIVILE IIC
Laboratoire des Structures Métalliques Résilientes RESSLab

Téléphone : +41 21 693 24 27
Fax : +41 21 693 28 68
E-mail : dimitrios.lignos@epfl.ch
Site web : http://resslab.epfl.ch
Address: EPFL ENAC IIC RESSLAB
GC B3 485, Station 18,
CH-1015, Lausanne

Exercise #3: Response to pulses and approximate analysis for short pulses

Problem 1

The 24-m-high full water tank shown in the figure is subjected to the force $p(t)$ shown in the figure caused by an aboveground explosion. The weight of the water when the tank is full is 160kN. The damping coefficient was measured from a free vibration test and was found to be, $c = 0.0063kN - sec/mm$ and its lateral stiffness $k = 0.5\,kN/mm$. Determine the following:

1. The natural vibration period and damping ratio of the structure with the tank full;
2. The maximum base shear and bending moment at the base of the tower supporting the tank.

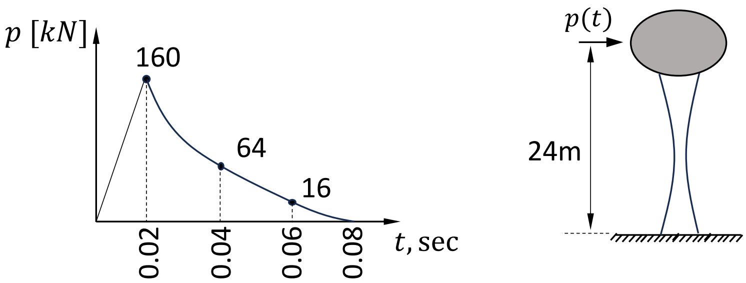

Figure 3.1

Problem 2

A one-storey building, idealized as a $h = 3.6$-m-high frame with two columns hinged at the base and a rigid beam, has a natural period of $0.5\ sec$. Each column has a rectangular cross section of $270\ mm\ x\ 100\ mm$. The Young's modulus of the material is $30GPa$. Neglecting damping, determine the maximum response of this frame due to a rectangular pulse force of amplitude $16kN$ and duration $t_d\ =\ 0.2sec$. Assume that the system is elastic. The response quantities of interest to be calculated are:

1. the displacement at the top of the frame; and
2. the maximum bending stress in the columns.

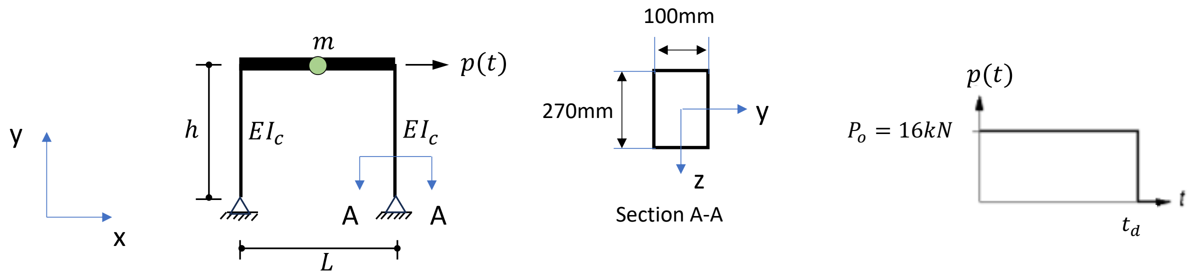

Figure 3.2