

Assignment 3: Response of SDF systems to periodic forces

Question 1:

Consider the same simple structure described in Question 2 of Assignment 1 (damped case).

Task 1: Construct a computer model of this simple structure using ETABS or SAP 2000. Subject the model to a periodic force (with amplitude $p_o = 1000\text{ N}$, period \bar{T} and circular frequency $\bar{\omega} = 2\pi\bar{f} = 2\pi/\bar{T}$, see Figure 1 below). Analyze the model and determine the forced vibration response of system under this periodic force.

Consider the following three cases.

- a) $\bar{f} = 0.5 f$
- b) $\bar{f} = 0.9 f$
- c) $\bar{f} = f$
- d) $\bar{f} = 1.1 f$
- e) $\bar{f} = 2 f$

Where f is the natural cyclic frequency of the SDF system. Use at-rest initial conditions (i.e. $u(0) = 0$, $\dot{u}(0) = 0$). Plot the displacement-vs-time response for each case.

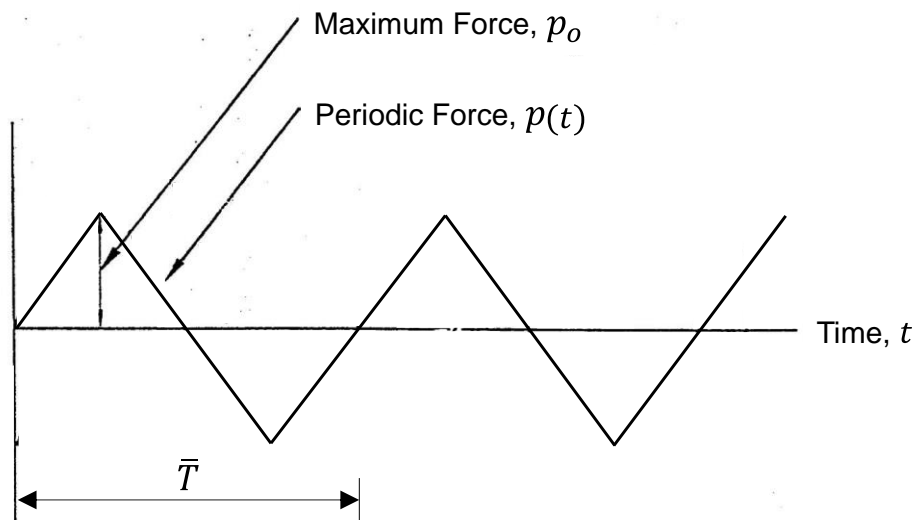


Figure 1: The periodic force

Task 2: For each case, determine the steady-state response of the system (under the same periodic force) using the analytical expressions derived in class. Plot the response in each case and find

maximum displacement, base shear and base moment. Compare the analytical results with those obtained from the computer program.