Prince of Songkla University

Faculty of Engineering

Midterm Examination: Semester II — Academic Year 20(7

Saturday, January 5, 2008 — Time 13:30-16:30

220-506 Stability of Structures — Room R300

Instructions.

1. There are 3 questions which marks are shown in the questions.
2. Attempt all questions.
3. Books and notes are allowed.
4. Pencils are recommended to be used in answering the questions.

Instructor : Fukit Nilrat

---

1. (20 marks) Find the critical load P_{cr} of the rigid bar-spring system shown in Fig. 1.
2. (30 marks) Find the critical load P_{cr} of the column shown in Fig. 2 by using the second–order differ ntial equation.
3. (30 marks) For the beam-column shown in Fig. 3.1, the deflection equations are given as

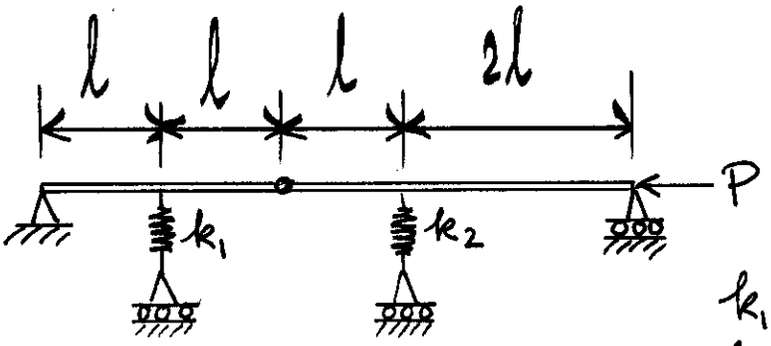
$$y(x) = \frac{Q}{EI\lambda^3}\frac{\sin\lambda(l-a)}{\sin\lambda l}\sin\lambda x - \frac{Q(l-a)}{lEI\lambda^2}\cdot x \qquad \text{for } 0 \le x \le a.$$

$$y(x) = -\frac{Q}{EI\lambda^3}\frac{\sin\lambda a}{\tan\lambda l}\sin\lambda x + \frac{Q\sin\lambda a}{EI\lambda^3}\cos\lambda x - \frac{Q\,a(l-x)}{lEI\lambda^2} \qquad \text{for } a \le x \le l$$

For the beam-column shown in Fig. 3.2

(a) Determine the maximum deflection y_o for the beam-column shown **in Fig. 3.2 when the axial lo ad P = 0.**

(b) The maximum deflection y_{max} for the beam-column shown in Fig. 3.2 when the axial load P is pr sent can be expressed as $y_{max} = y_o A_F$. By using the principle of superposition, find the deflection amplifi ation factor A_F in terms of u where $u = \lambda l/2$.



$k_1 = k$

$k_2 = 2k.$

Fig. 1

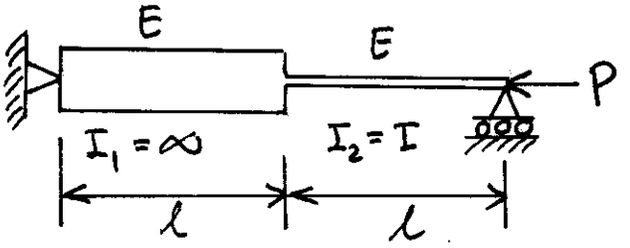


Fig. 2

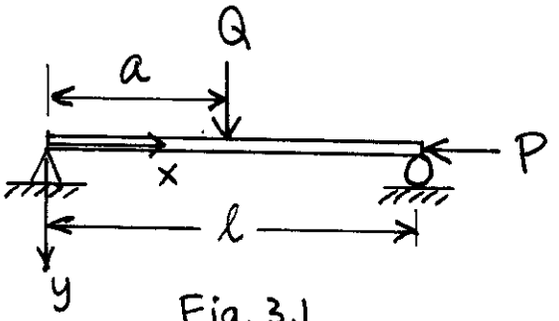


Fig. 3.1

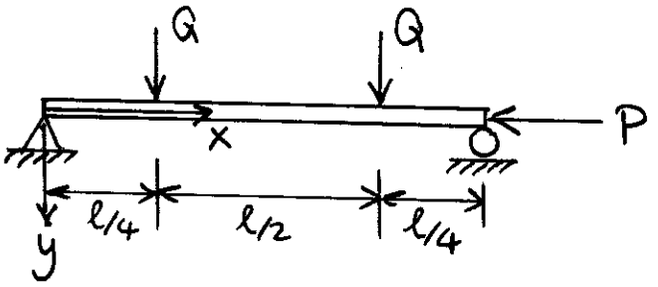


Fig. 3.2