

# ΠΠΜ 220: Στατική Ανάλυση των Κατασκευών Ι

## Διάλεξη 38

### 11<sup>η</sup> Άσκηση

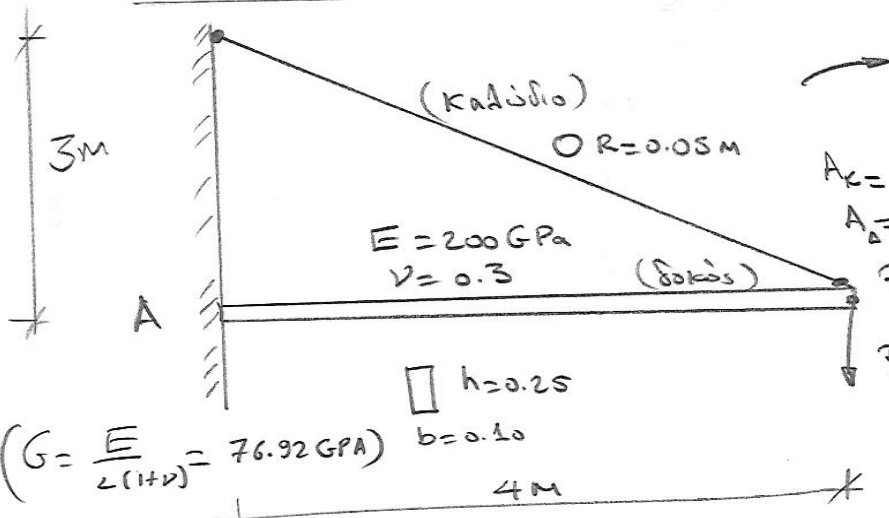
Παρασκευή 3 Δεκεμβρίου, 2004

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11<sup>η</sup> Σηράδα ΑΣΚΗΣΕΩΝ:



1 σταθ ανεφάρμακτα  
ελασ.

$$A_c = \pi R^2 = 7.854 \times 10^{-3}$$

$$A_d = b \cdot h = 0.25 \times 0.10 = 0.025 \text{ m}^2$$

$$A_{dy} = \frac{A_d}{1.2} = 2.083 \times 10^{-2}$$

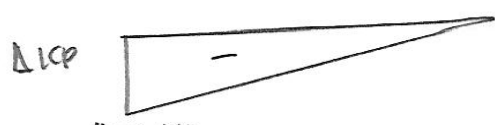
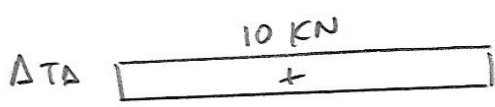
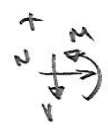
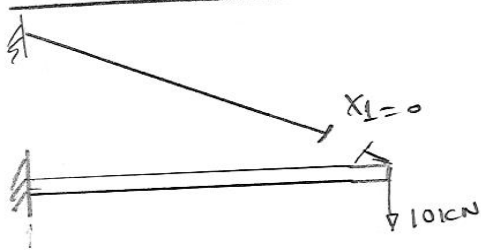
$$P = 10 \text{ kN}$$

$$I = \frac{bh^3}{12} = \frac{0.1 \times 0.25^3}{12} = 1.3021 \times 10^{-4}$$

$$G = \frac{E}{2(1+\nu)} = 76.92 \text{ GPa}$$

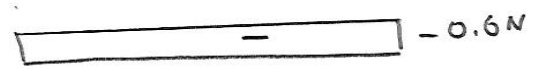
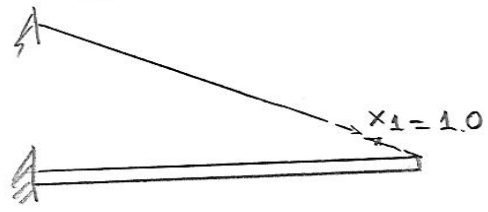
Θεωρούμε τις αξονικές δυνάμεις και ρομές στον σταθ  
ανεφάρμακτων δυνάμεων (κέντρο στο κέντρο του σταθ)

Στοιός "0"



$$-40 \text{ kNm}$$

Στοιός "1"



$$2.4 \text{ kNm}$$

$$\delta_{10} = \frac{4 * 10000 * (-0.6)}{76.92 * 10^9 * 2.083 * 10^{-2}} + \frac{4 * (-40000) * 2.4}{3 * 200 * 10^9 * 1.3021 * 10^{-4}}$$

$$\hookrightarrow \delta_{10} = -1.498 * 10^{-5} - 4.9151 * 10^{-3} = -4.93 * 10^{-3}$$

$$\delta_{11} = \frac{5 * 1 * 1}{200 * 10^9 * 7.854 * 10^{-3}} + \frac{4 * (-0.8) * (-0.8)}{200 * 10^9 * 0.025} + \frac{4 * (-0.6) * (-0.6)}{76.92 * 10^9 * 0.02083} + \frac{4 * (-2.4) * (-2.4)}{3 * 200 * 10^9 * 1.3021 * 10^{-4}}$$

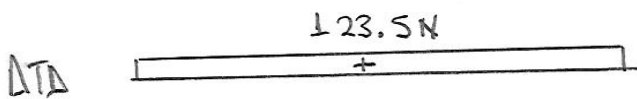
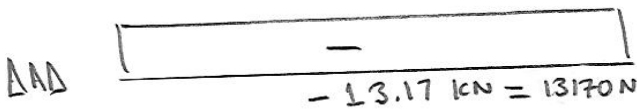
$$\hookrightarrow \delta_{11} = 3.18 * 10^{-9} + 5.12 * 10^{-10} + 8.987 * 10^{-10} + 2.9491 * 10^{-7}$$

$$\hookrightarrow \delta_{11} = 2.995 * 10^{-5}$$

$$\delta_{10} + \delta_{11} * X_1 = 0 \rightarrow X_1 = - \frac{-4.93 * 10^{-3}}{2.995 * 10^{-5}} = \underline{16.46 \text{ kN}}$$

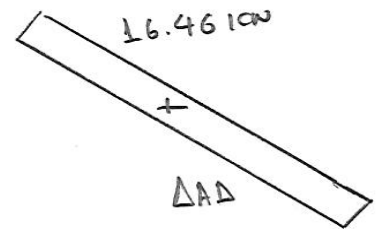
### Τελικά Διαγράμματα

Δοκοί :



A

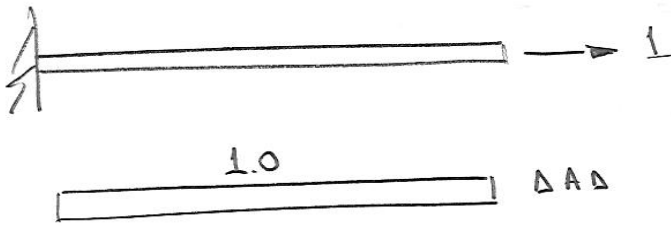
Καλώδιο:



B

Από φέρουσα των  
Προσώπων  
Διαγράμματος

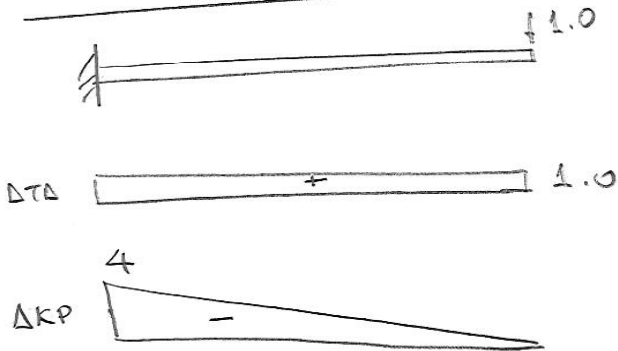
- Μετακίνηση  $\Delta_x^B$ :



$$\Delta_x^B = \frac{4 \times 1.0 \times 13170}{200 \times 10^9 \times 0.025}$$

$$\Delta_x^B = 1.05 \times 10^{-5} \text{ m}$$

- Μετακίνηση  $\Delta_y^B$ :



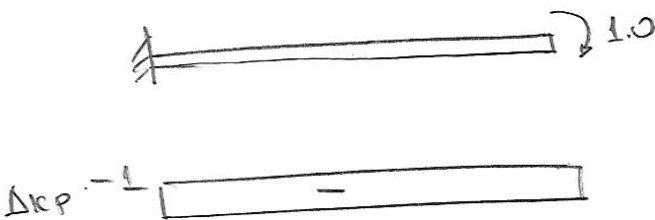
$$\Delta_y^B = \frac{4 \times 123.5 \times 1.0}{76.92 \times 10^9 \times 2.083 \times 10^{-2}} + \frac{4 \times (-496) \times (-1)}{3 \times 200 \times 10^9 \times 1.3021 \times 10^{-4}}$$

$$\Delta_y^B = 3.08 \times 10^{-7} + 1.016 \times 10^{-4}$$

$$\Delta_y^B = 1.019 \times 10^{-4} \text{ m}$$

$$\Delta_y^B = 0.1 \text{ mm}$$

- Στροφή  $\theta_z^B$ :



$$\theta_z^B = \frac{4 \times (-496) \times (-1)}{2 \times 200 \times 10^9 \times 1.3021 \times 10^{-4}}$$

$$\theta_z^B = 3.81 \times 10^{-5} \text{ radians}$$