Lecture 17
VERESCAGIN'S RULE

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Plan of lection

- 1. General theory of Verescagin's rule
- 2. The first example of application
- 3. The second example of application

General theory of Verescagin's rule

$$\delta = \sum_{i=1}^{n} \frac{\omega_i \cdot M_{C_i}}{EI} \qquad \textbf{(1)}$$

where

ω_i **is the elementary moment area;**

M_{C_i} **is the ordinate of the unite force moment under the centroid of** ω_i **;**

Example 1

Condition:

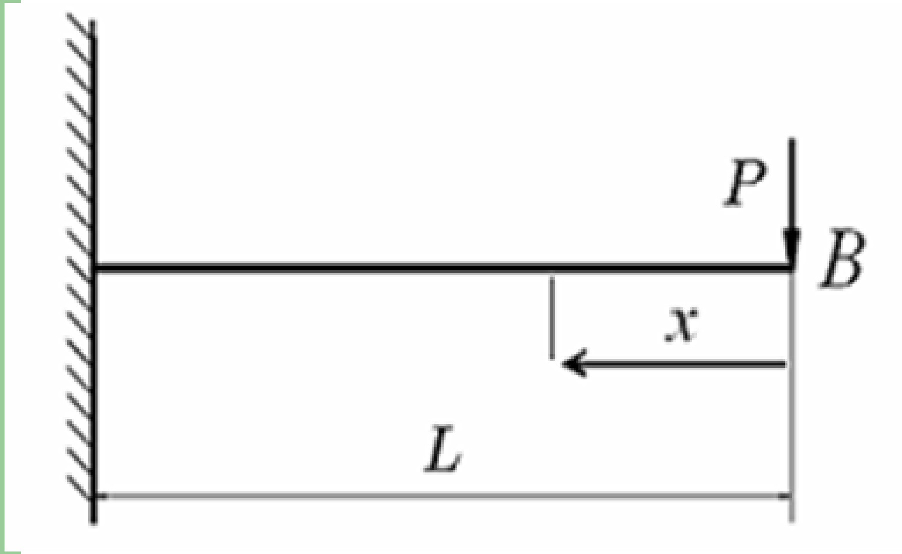


Fig. 1

Determine by Verescagin's rule the beam deflection at point **B**

Example 1

The diagram of bending moment for the load state M^F

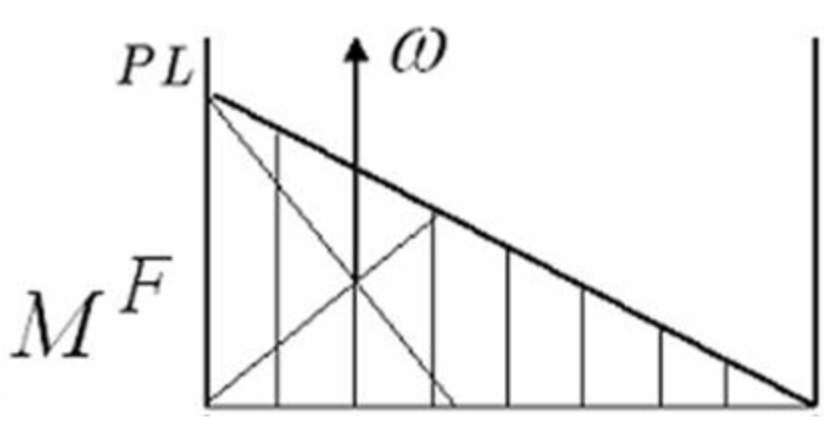


Fig. 2

Example 1

The diagram of bending moment for the load state M^F

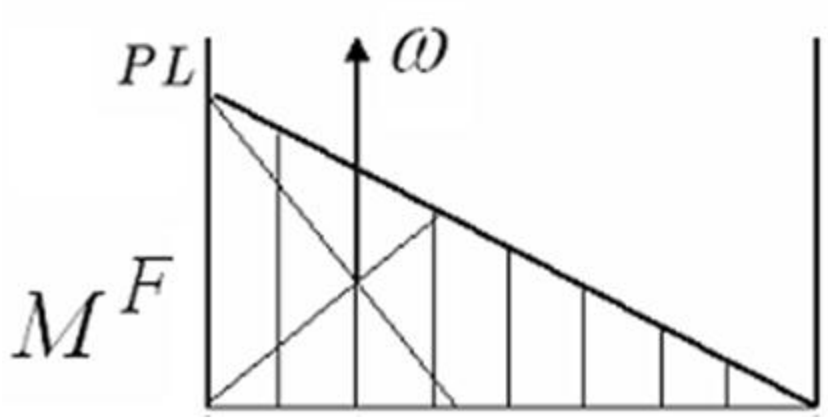


Fig. 2

The calculation of area ω

$$\omega = \frac{1}{2}(-PL)\cdot L = -\frac{PL^2}{2}$$

Example 1

The diagram of bending moment for the unit state M^1

The calculation of parameter M_c

$$M_C = -\frac{2}{3}L$$

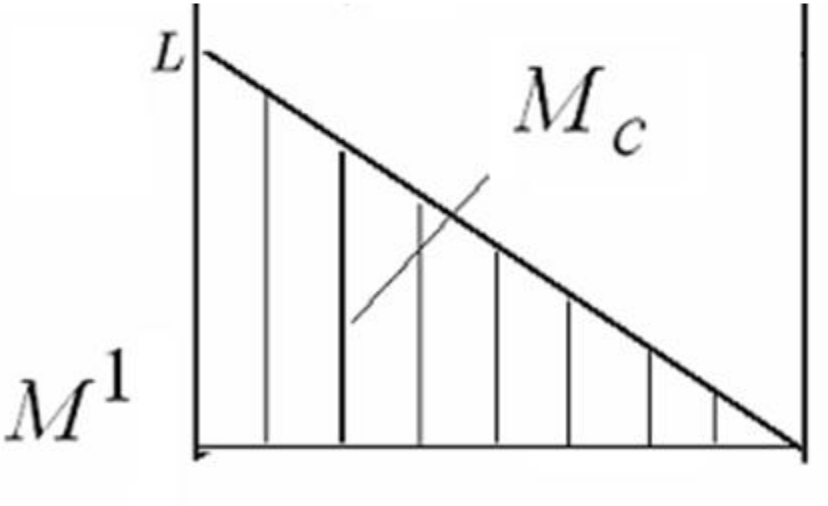


Fig. 3

Example 1

By a formula (1) we obtain:

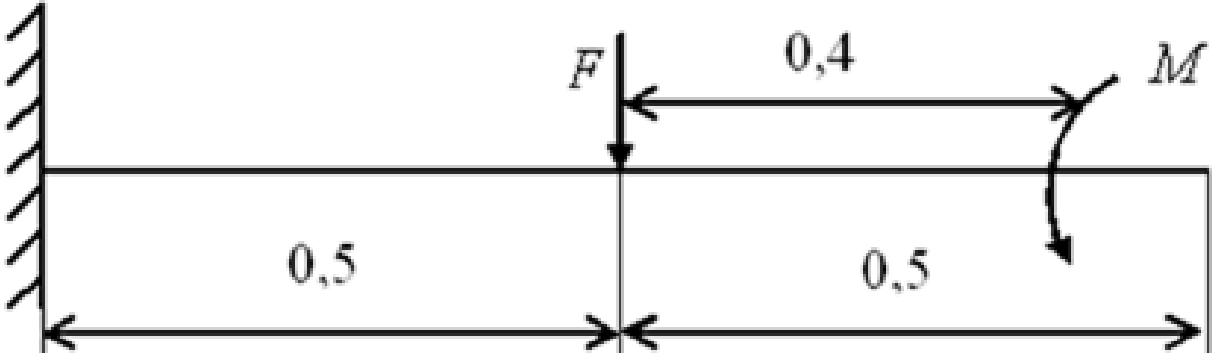
$$\delta_B = \frac{1}{EI_x}\left(-\frac{PL^2}{2}\right)\left(-\frac{2}{3}L\right) = \frac{PL^3}{3EI_x} \quad \textbf{(2)}$$

Example 2

Condition:

Find the deflection of free end for given beam

$$M = \alpha P\ell = 0{,}125$$



$$F = 0{,}5$$

Fig. 4

Example 2

The diagram of beanding moment M_F

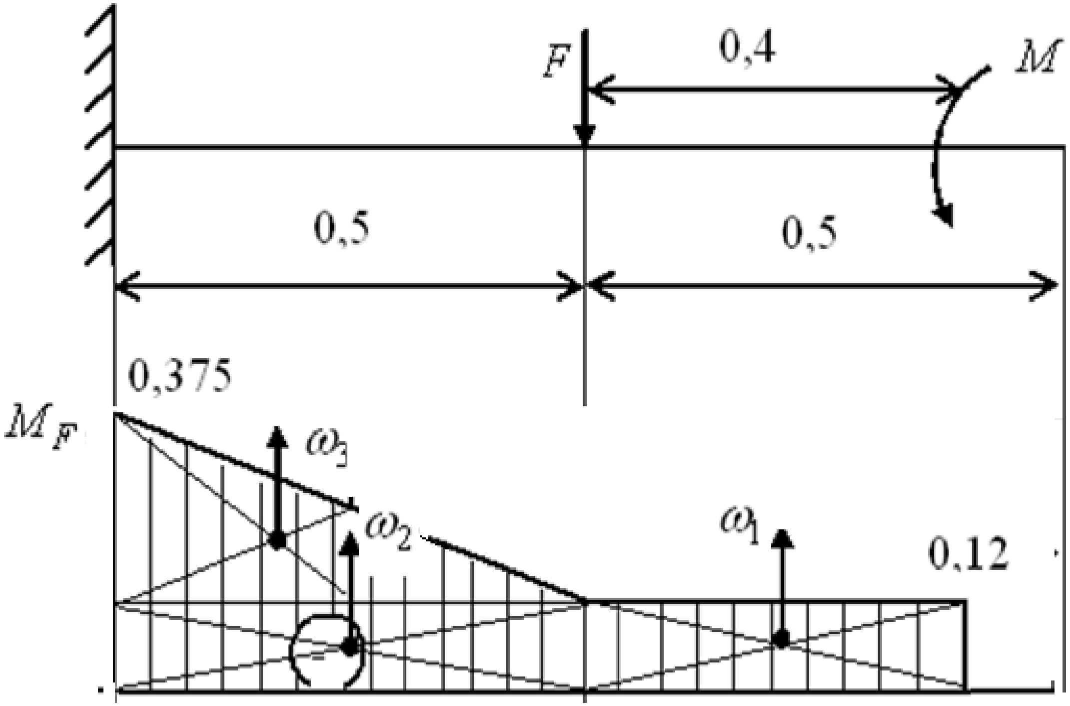


Fig. 5

Example 2

The diagram of beanding moment M^1

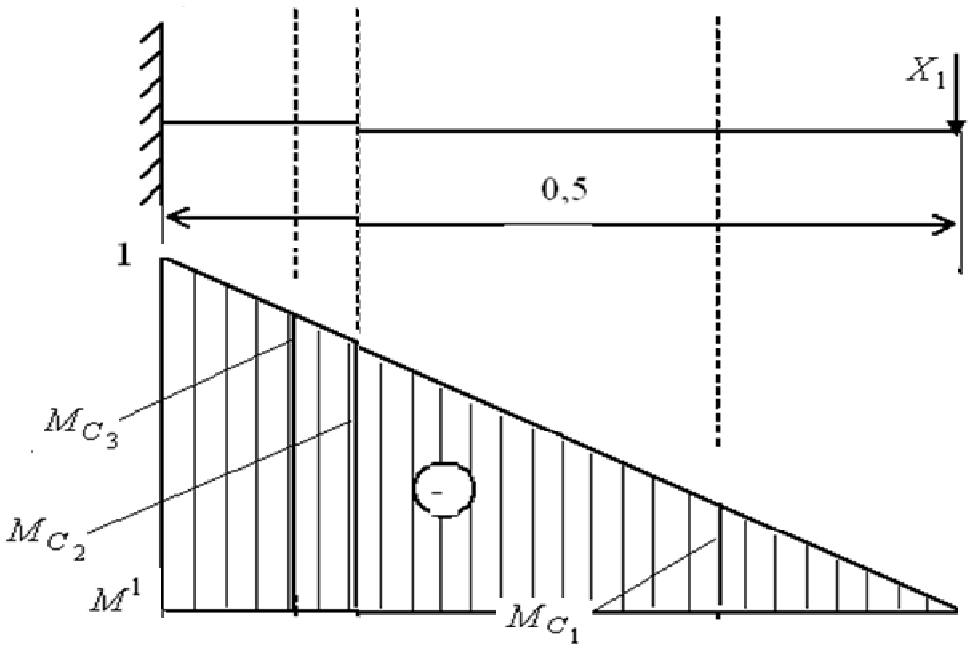
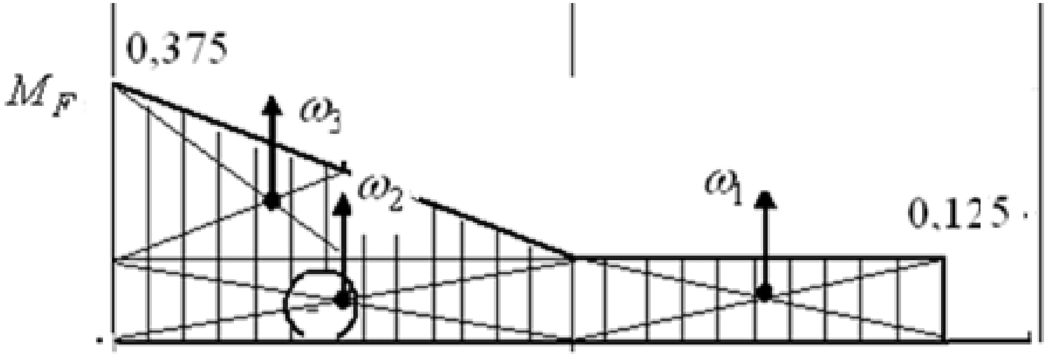


Fig. 6

Example 2

Using Fig.5, we find the value of the areas



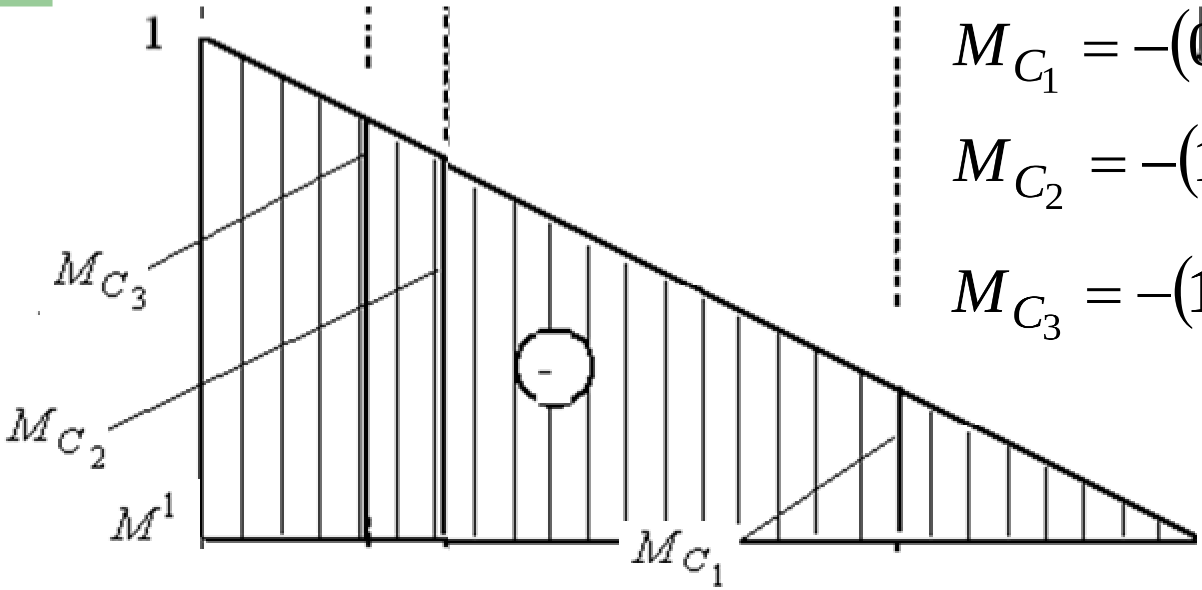
$$\omega_1 = 0{,}4 \cdot \left(-0{,}125\right) = -0{,}05$$ **Nm;**

$$\omega_2 = 0{,}5 \cdot \left(-0{,}125\right) = -0{,}0625$$ **Nm;**

$$\omega_3 = 0{,}5 \cdot 0{,}5 \cdot \left(-0{,}25\right) = -0{,}0625$$ **Nm**

Example 2

Then the corresponding ordinates of the centroids M_{C_i} will be equal:



$$M_{C_1} = -(0{,}1 + 0{,}5 \cdot 0{,}4) = -0{,}3$$ **m;**

$$M_{C_2} = -(1 - 0{,}25) = -0{,}75$$ **m;**

$$M_{C_3} = -(1 - 0{,}5 \cdot 0{,}33) \approx -0{,}835$$ **m**

Example 2

By a formula (1) we obtain:

$$y = \frac{1}{EI}\{0{,}05\cdot 0{,}3 + 0{,}0625\cdot 0{,}75 + 0{,}0625\cdot 0{,}835\} \approx$$

$$\approx \frac{0{,}114}{EI} \qquad \textbf{(3)}$$