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# CROSS SECTIONAL CENTER OF MASS

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Book 7



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Designer's Den

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# Definition

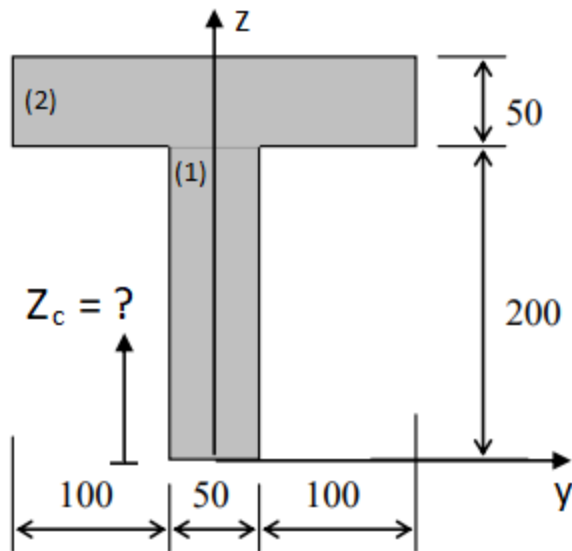
The center of mass, or centroid, is an important concept used in various fields, including physics, engineering, and mechanics. It refers to the average position of the mass distribution within an object or system. The center of mass is often used as a reference point for analyzing the motion, stability, and equilibrium of objects or systems.

For cross sections with multiple shapes, you can find the centroid by dividing the section into simpler shapes (such as rectangles, triangles, or circles), calculating the centroid of each shape, and then determining the overall centroid using the weighted average of the individual centroids.

For more complex shapes, such as irregular polygons, the centroid can be found using mathematical integration methods or by using computer-aided design software that provides centroid calculation tools.

# Examples

**Example 1:** Find the centroid of the following cross-section:

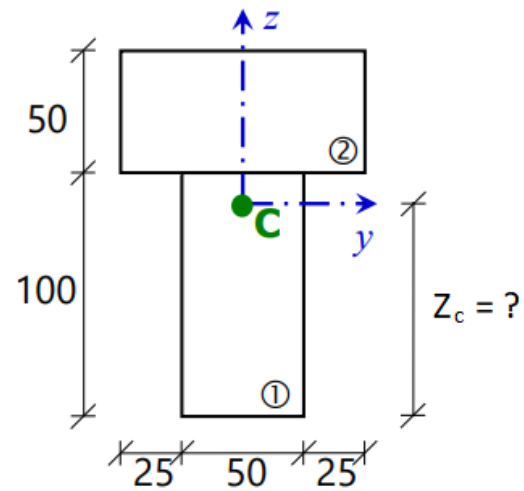


**Solution:**

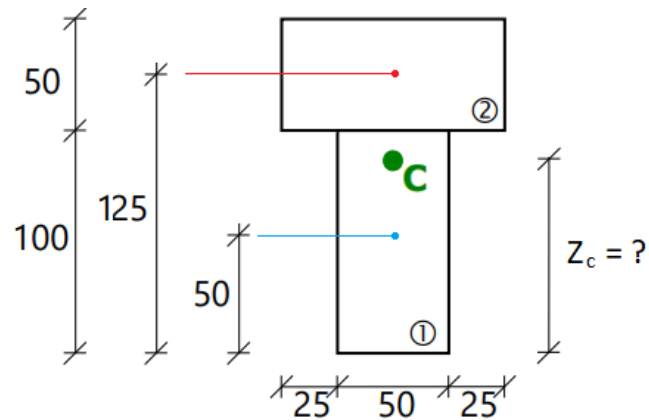
$$A_1 = 50 \cdot 200 = 10000 \text{ mm}^2 ; A_2 = 50 \cdot 250 = 12500 \text{ mm}^2 ; A = 22500 \text{ mm}^2$$

$$Z_c = (100 \cdot 10000 + 225 \cdot 12500) / 22500 = 169,44 \text{ mm}$$

**Example 2:** Find the centroid of the following cross-section:



**Solution:**



$$Z_c = \frac{\sum A_i \cdot z_i}{A_{\text{Total}}} = \frac{A_1 \cdot z_1 + A_2 \cdot z_2}{A_1 + A_2} = \frac{(50 \cdot 100) \cdot 50 + (100 \cdot 50) \cdot 125}{(50 \cdot 100) + (100 \cdot 50)}$$

$$Z_c = 87.5$$