Structure Properties

FORMULAS FOR GEOMETRICAL PROPERTIES OF SECTIONS

Cross-section area	$A = \int_A dA$
First moment	$S_x = \int_A y \, dA, \quad S_y = \int_A x \, dA$
Position of centroid	$\bar{x} = \dfrac{S_y}{A}, \quad \bar{y} = \dfrac{S_x}{A}$
Moment of inertia	$J_x = \int_A y^2 dA, \quad J_y = \int_A x^2 dA$
Product of inertia	$J_{xy} = \int_A xy \, dA$
Polar moment of inertia	$J_p = \int_A r^2 dA = J_x + J_y$
Radius of gyration	$i_x = \sqrt{\dfrac{J_x}{A}}, \quad i_y = \sqrt{\dfrac{J_y}{A}}$
Polar radius of gyration	$i_p = \sqrt{\dfrac{J_p}{A}}$
Section modulus	$Z_1 = \dfrac{J}{y_1}, \quad Z_2 = \dfrac{J}{y_2}$
Transition of axis	$S_x' = S_x - Ad, \quad S_x = A\bar{y}$ $J_x = J_x + A\bar{y}^2, \quad J_{xy} = J_{XY} + \bar{x}\bar{y}$
Rotation of axis	$S_x' = S_x \cos\alpha - S_y \sin\alpha$ $J_x' = J_x \sin^2\alpha + J_y \cos^2\alpha + J_{xy} \sin\alpha$ $J_x' + J_y' = J_x + J_y = J_p$