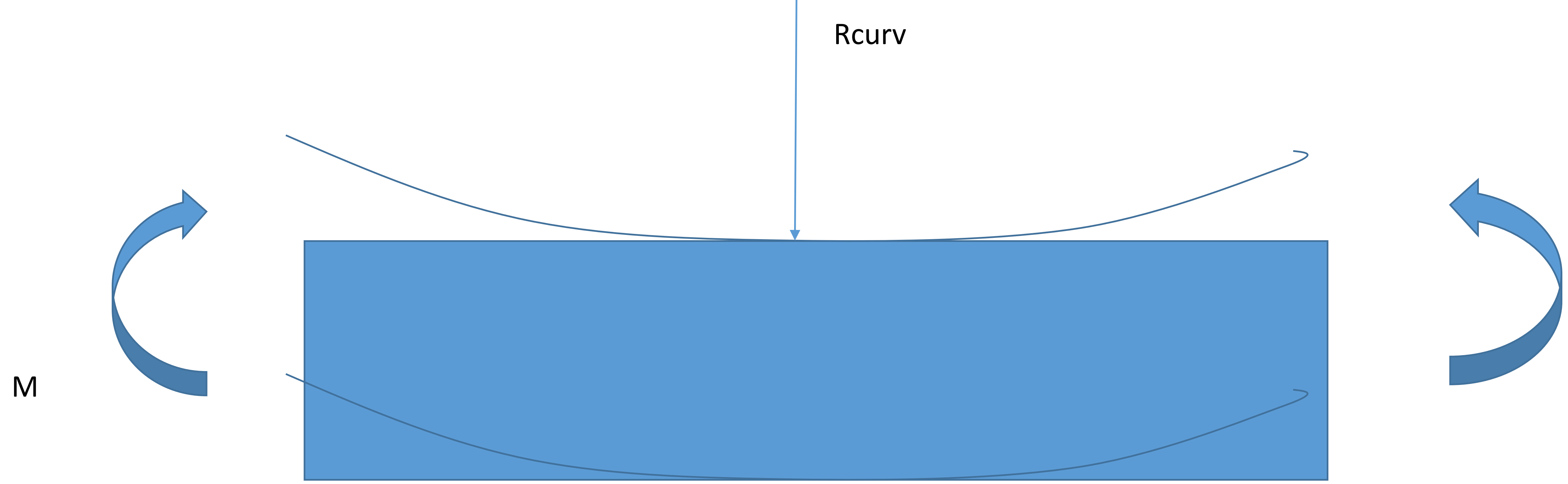


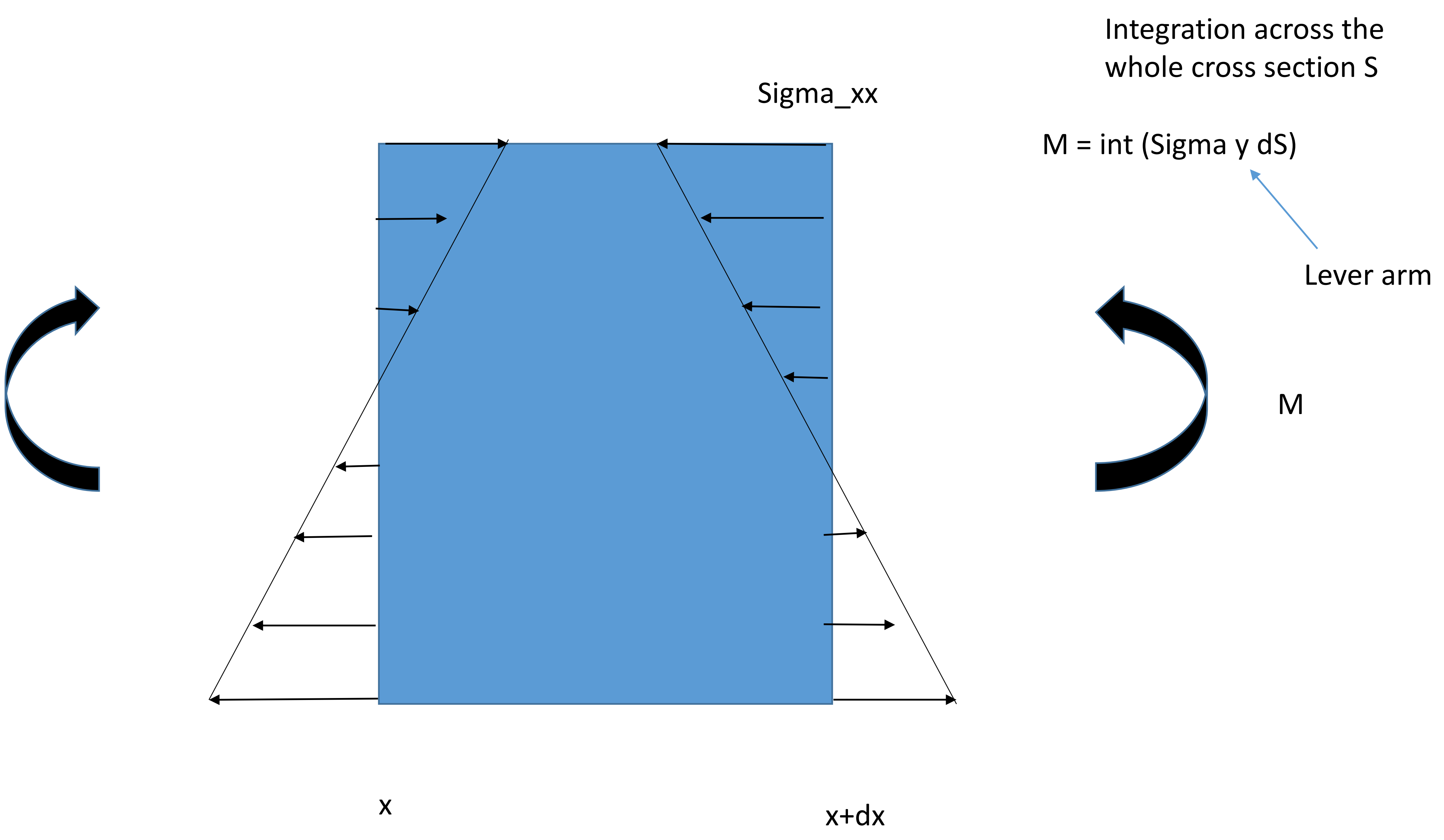
The bending moment => curvature of the beam

Curvature = 1/Rcurv

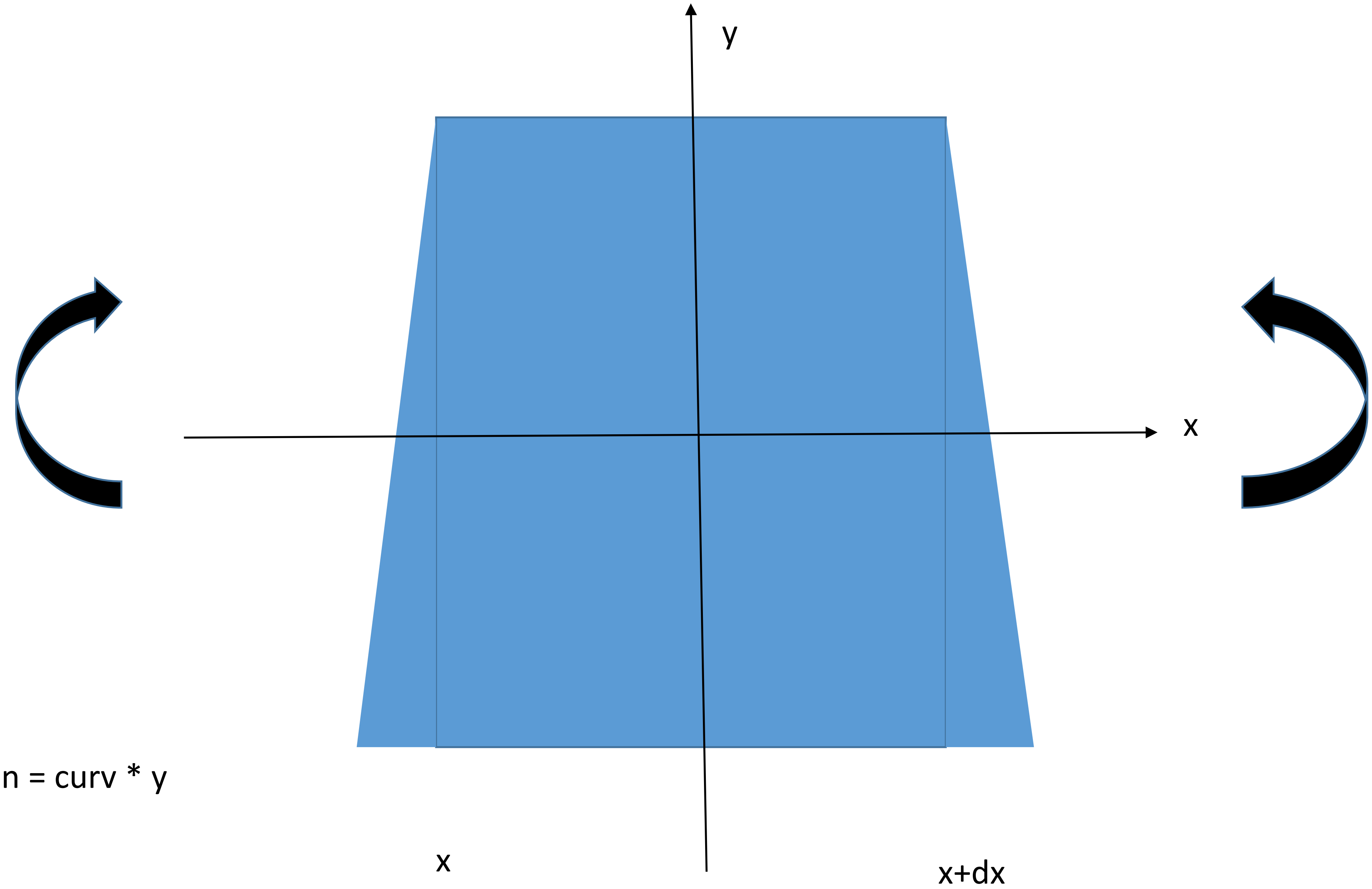
Elasticity => M = kappa Curvature = kappa / Rcurv

Power = M dRotation = M L dCurvature = kappa Curvature L dCurvature

Energy = integral over time (Power) = ½ kappa L curvature^2



Integration across the whole cross section S
Sigma_xx
M = int (Sigma y dS)
Lever arm
M
x
x+dx



Strain = curv * y

Elasticity

Hooke's law: Sigma = Y epsilon = Y curv y

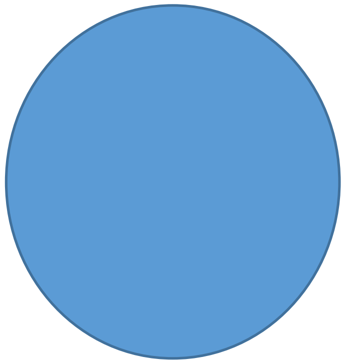
Y is the elastic(Young's) modulus

$M = \int (\sigma\, y\, dS)$

$M = Y\,\text{curv} \int (y^2\, dS)$

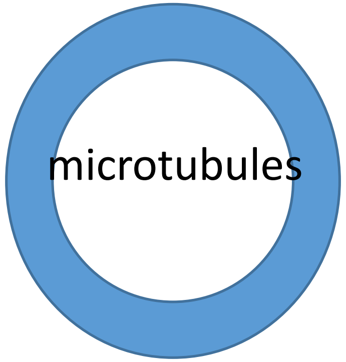
I/S = ratio between momnt of inertia and cross section area

Moment of inertia of the beam: I



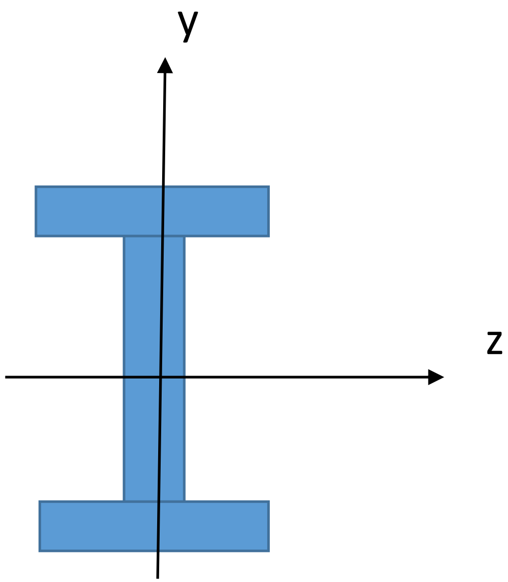
$I = \pi R^4/4$
$S = \pi R^2$

$I/S = R^2/4$



$I = \pi(Ro^4-Ri^4)/4$
$S = \pi(Ro^2-Ri^2)$

$I/S = (Ro^2+Ri^2)/4$
$= R^2/2$



Beam in civil eng

Thermodynamics

Probability of having the filament with energy E

$P(E) = A \exp(-E/kT) = A \exp(-YI\, L/(2kT\, R^2)$

$YI\, L/(2kT\, R^2)$

$YI/(kT)$ = dimension is m => persistence length

$L/(2R^2)$ = dimension is 1/m