

buckling( $l, r, E, \lambda, \sigma$ ) computes the slenderness  $\lambda$ , critical buckling stress  $\sigma$ , length  $l$ , radius of gyration  $r$  and Young's modulus  $E$  knowing some combinations of 3 of them.

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buckling ( l , r , E , λ , σ ) :=
  U# := Unknowns ( [ l λ r σ E ] )
  U# := concat ( num2str ( U# 1 ) , " & " , num2str ( U# 2 ) )
  if num2str ( IsDefined ( l ) ) = "0"
    l := r · λ
  if num2str ( IsDefined ( r ) ) = "0"
    r :=  $\frac{l}{\lambda}$ 
  if num2str ( IsDefined ( λ ) ) = "0"
    λ :=  $\frac{l}{r}$ 
  if num2str ( IsDefined ( σ ) ) = "0"
    σ :=  $\frac{\pi^2}{\lambda^2} \cdot E$ 
  if num2str ( IsDefined ( E ) ) = "0"
    E :=  $\frac{\lambda^2}{\pi^2} \cdot \sigma$ 
  if num2str ( IsDefined ( λ ) ) = "0"
    λ :=  $\pi \cdot \sqrt{\frac{E}{\sigma}}$ 
  if num2str ( IsDefined ( [ l λ r σ E ] ) ) = "0"
    error ( concat ( "Can't solve for " , U# ) )
  else
    U#

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$E_{st} := 210 \text{ GPa}$      $L := 5 \text{ m}$      $r_1 := 3 \text{ cm}$

$\text{buckling} ( L , r_1 , E_{st} , \lambda_1 , \sigma_c ) = \text{"}\lambda.1 \text{ \& \sigma.c"}$      $\lambda_1 = 166.7$      $\sigma_c = 74.61 \text{ MPa}$

$\text{Clear} ( E_{st} , \lambda_1 ) = 1$      $\text{buckling} ( L , r_1 , E_{st} , \lambda_1 , \sigma_c ) = \text{"E.st \& \lambda.1"}$      $E_{st} = 210 \text{ GPa}$      $\lambda_1 = 166.67$

$\text{Clear} ( E_{st} , L ) = 1$      $\text{buckling} ( L , r_1 , E_{st} , \lambda_1 , \sigma_c ) = \text{"E.st \& L"}$      $E_{st} = 210 \text{ GPa}$      $L = 5 \text{ m}$

$\text{Clear} ( E_{st} , r_1 ) = 1$      $\text{buckling} ( L , r_1 , E_{st} , \lambda_1 , \sigma_c ) = \text{"E.st \& r.1"}$      $E_{st} = 210 \text{ GPa}$      $r_1 = 3 \text{ cm}$

$\text{Clear} ( L , r_1 ) = 1$      $\text{buckling} ( L , r_1 , E_{st} , \lambda_1 , \sigma_c ) = \blacksquare$

**lastError = "Can't solve for L & r.1"**

$L := 5 \text{ m}$      $r_1 := 3 \text{ cm}$

$\text{Clear} ( E_{st} , \sigma_c ) = 1$      $\text{buckling} ( L , r_1 , E_{st} , \lambda_1 , \sigma_c ) = \blacksquare$

**lastError = "Can't solve for E.st & σ.c"**

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