Theory of structure

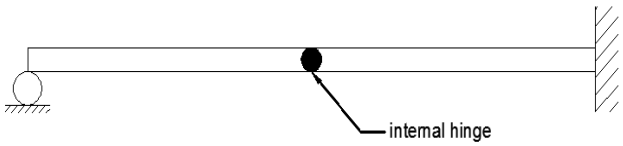
Stability and determinacy of structures

Beams

- Total equation of equilibrium of beam
  $\sum F_X = 0$
  $\sum F_Y = 0$
  $\sum M = 0$

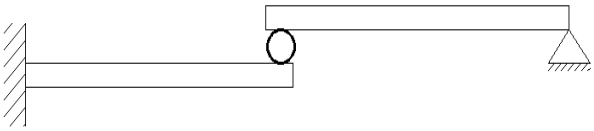
- Equation of condition
  Internal hinge:-

$\sum M = 0$



C=1
C = m - 1

Roller:-
$\sum M = 0$
$\sum F_X = 0$
C=2

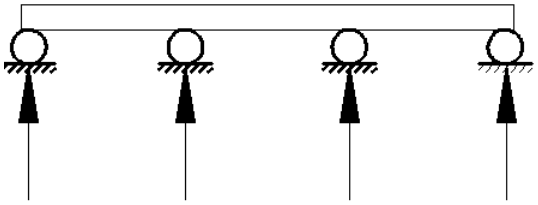


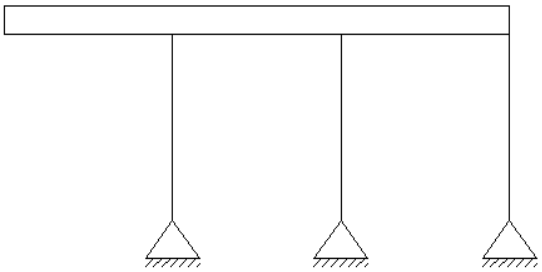
Let r= No. of reaction
1- If r < c+3, unstable
2- r = c+3, determine if stable
3- r> c+3, indeterminate if stable
Let (m) degree of indeterminate
m= r- (c+3)

- the structure is said to be unstable if one of the following facts couter

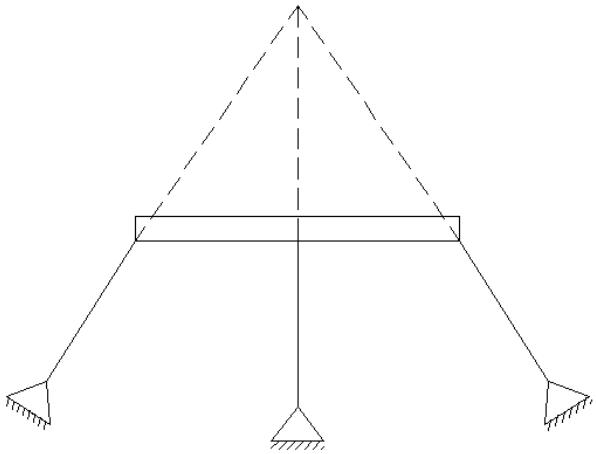
1- $r < c+3$

2- The reaction element constitutes a parallel force system.





3- The reaction element constitutes a concurrent force system.



4- Internal geometric instability:-

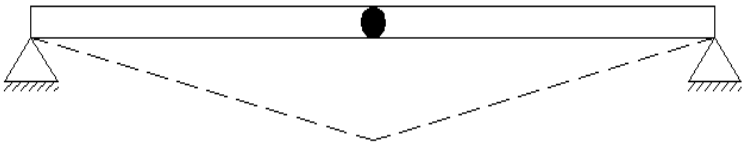
Example

r = 4

c =1

r = c+3

4=4



The beam is unstable because the Internal geometric instability

Example

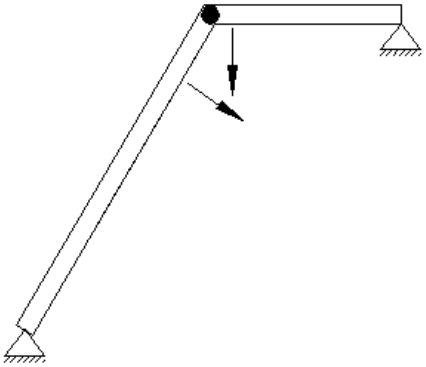
r = 4

c = m-1, c =1

r = c+3

4=4

The beam is determiate if stable



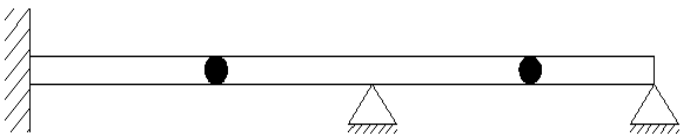
Example

r= 7

c= 2

r>c+3

7>5



The beam is indeterminate 2nd degree if stable

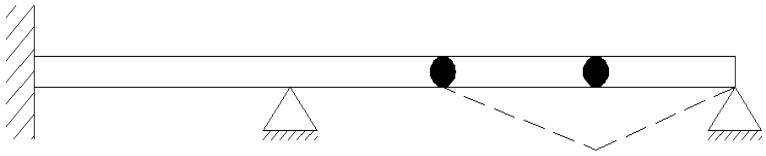
Example

r= 7

c= 2

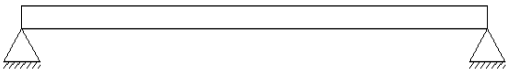
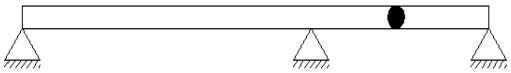
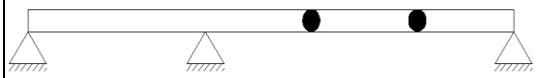
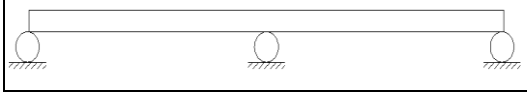
r>c+3

7>5



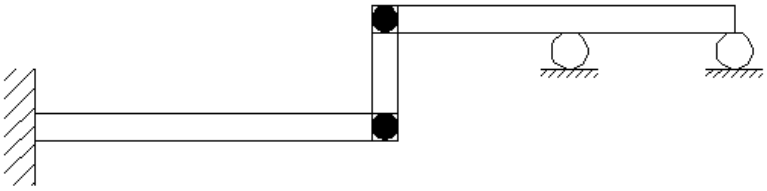
The beam is unstable

Examples:-

Beam	r	c	c+3	state	Stability & determinate.
	3	0	3	r=c+3	Stable & deter.
	4	0	3	r>c+3	Stable & indeter. First degree
	6	1	4	r>c+3	Stable &indeter. Second degree
	6	2	5	r>c+3	unstable
	3	0	3	r =c+3	unstable

Home Works

H.W1: Find the stability and determinacy of beam.



H.W2: Find the stability and determinacy of beam.