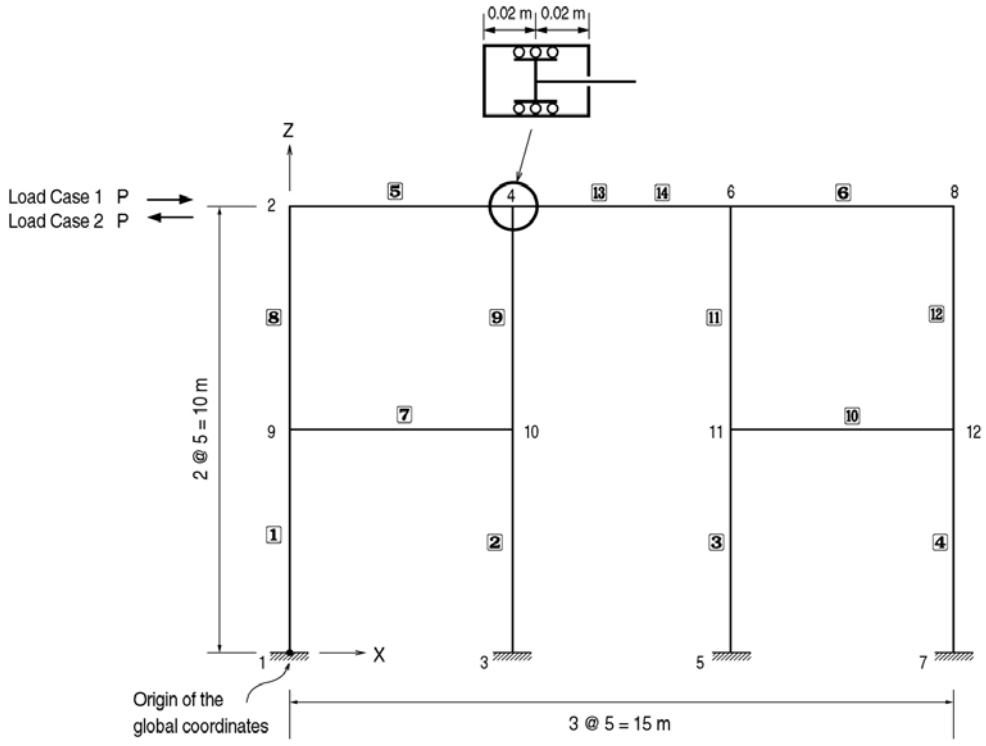
# BNL-2

## Title

Analysis of a structure with nonlinear elements

## Description

Analyze a structure which is comprised of two frames connected to each other by special displacement conditions.




*Structural geometry and analysis model*

# Model

***Analysis Type***

2-D static analysis

***Unit System***

m, kN

***Dimension***

Length 15 m Height 10m

***Element***

Beam element, hook element and gap element

***Material***

Modulus of elasticity $E = 2.0594 \times 10^8$ kN/m$^2$

Poisson's ratio $\nu = 0.3$

Weight Density $\rho = 76.98$ kN/m$^3$

***Section Property***

I-Section $250 \times 255 \times 14/14$ mm

***Boundary Condition***

Nodes 1, 3, 5 and 7 : Constrain all DOFs. (Fixed supports)

Connectivities of two frames : Compression-only element(Hook) and tension-only element(Gap) with 0.02m space are used separately.

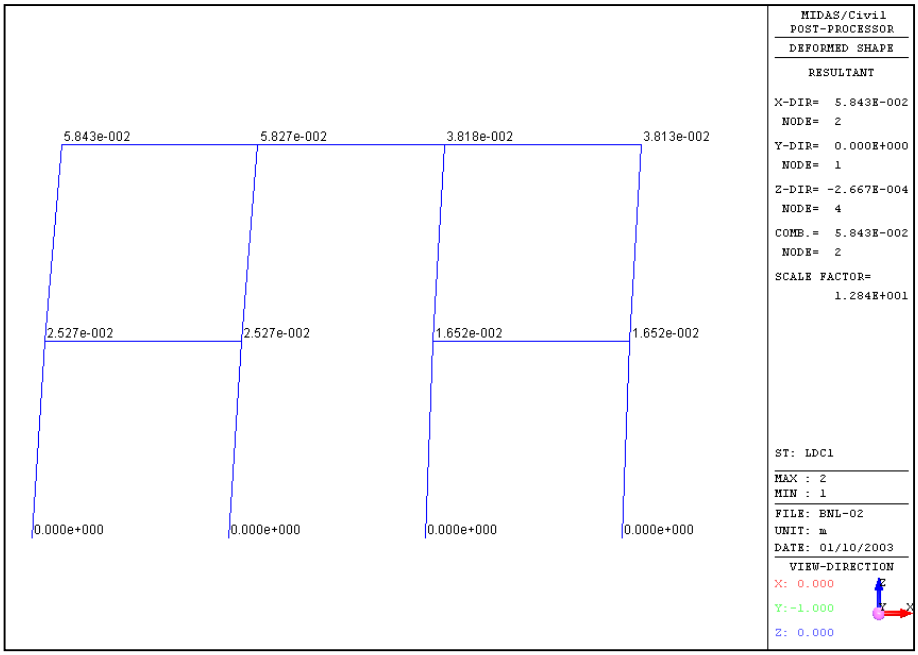
***Load Case***

Concentrated loads are applied to the node 2 in the X direction.

Load Case 1 ; $P_1 = 100$kN

Load Case 2 ; $P_2 = -100$kN

## Results




*Deformed shape of the structure (Load Case 1)*

## Comparison of Results

Unit : kN, m

| | Result | Theoretical | MIDAS/Civil |
|---|---|---|---|
| Load Case 1 | X displacement at the node 4 | 0.05826655 | 0.05826646 |
| | Axial force of the gap element | -39.536 | -38.790 |
| Load Case 2 | X displacement at the node 4 | -0.05826655 | -0.05826646 |
| | Axial force of the hook element | 39.536 | 38.790 |