FORMED43 - Practical works of the formation “Génie Civil”: Inflection 3 points of a reinforced concrete beam.

Summary:

The problem consists in analyzing the answer of a reinforced concrete beam in inflection 3 points until the ruin with a multifibre modeling beam $S$ [R3.08.08]. CE test corresponds to a static analysis of a beam having a non-linear behavior. LE concrete is modelled with the law of behavior endommageable lenitive of Mazars in its version 1 $D$ [R7.01.08]. L' ac1st is modelled with a law elastoplastic.

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1 General characteristics

1.1 Geometry

The beam in inflection three points studied 5m measurement length. Its section is of 0.2x0.5m. Its geometry as well as the positioning of steels which constitute it are defined on Figure 1.1-a.

Figure 1.1-a : Plan of the beam.
1.2 Material properties

- Béton: class of resistance 'C30/37' or 'C35/45'

![Figure 1.2-a: Examples of answer with law Mazars 1D.](image1)

- Steel:

  FE400: $f_{yk} = 400 \text{ MPa}$

  Tangent module (plastic slope)
  $E_T = 1200 \text{ MPa}$

![Figure 1.2-b: Courbe stress-strain of steel.](image2)

1.3 Boundary conditions and loadings

Simple support in $B: DY = 0$.
Support doubles in $A: DX = DY = DZ = 0$ just as $DRX = DRY = 0$.

Quasi-static loading: monotonous displacement $DY$ to the bottom applied to mid-span in $C$ (deflection test 3 points), according to a linear function of time:

<table>
<thead>
<tr>
<th>$t$</th>
<th>$DY$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,0</td>
<td>0,0 cm</td>
</tr>
<tr>
<td>3,0</td>
<td>−3,0 cm</td>
</tr>
<tr>
<td>5,0</td>
<td>−5,0 cm</td>
</tr>
</tbody>
</table>
2 Modeling

2.1 Implementation of the TP

2.1.1 Realization of the grids

- Grid of the beam (15 to 20 elements).
- Grid of the cross-section of the beam (20 to 25 elements in the height, 2 to 5 elements in the width).

2.1.2 Definition of fibres

- Use of the order **DEFI_GEOM_FIBRE [U4.26.01]** to define the cross-section multifibre of the beam.
- Visualization of the fibre section with **CREA_MAILLAGE [U4.23.02]**.

2.1.3 Definition of materials

Definition of materials by using the order **DEFI_MATER_GC [U4.42.07]**.

2.1.4 Checks of the data

Visualization the cross-section of the beam multifibre with the local reference marks.

2.1.5 Calculation

To further carry out calculation possible.

2.1.6 Postprocessings

Reaction of support according to the arrow in the center

Evolutions of Déformations:

- DeformationS concrete tended and compressed.
- DeformationS tended steels and compressed.
Evolutions of Contraintes:
- Contraintes DU tended concrete and compressed.
- Contraintes steelS tendedS and compressed.

Figure 2.1.6-a : Evolutions of the constraints in steels according to time.

Figure 2.1.6-b : Evolutions of the constraints in the concrete according to time.
Figure 2.1.6-c : Evolutions of the constraints in the concrete according to the deformations.

Figure 2.1.6-d : Evolutions of the reaction of support according to the arrow.