
SSLS112 - Eccentring of Summarized composite

plates:

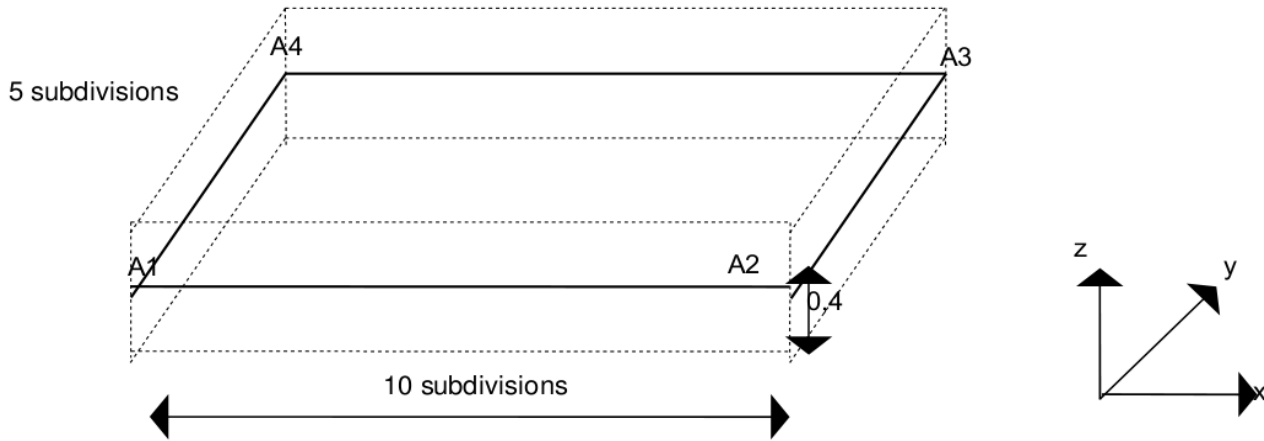
This test makes it possible to validate the eccentring of composite plates.

The reference is given by a first resolution where one models a quadri-layer presenting nona - material symmetry compared to the average plane.

The validation is done in the second computation where one models to it quadri-layer of the preceding model by 2 double-layered offset compared to the average plane of the first computation.

1 Problem of reference

1.1 Geometry



coordinated of the points (in m): $A1(0,0,0)$ $A2(10,0,0)$ $A3(10,5,0)$ $A4(0,5,0)$

1.2 Material properties

the material consists of 4 orthotropic layers of thickness 0.1.

The first layer is characterized by:

$$EL=20000.10^6 Pa \quad ET=20000.10^6 Pa \quad VLT=0.3 \quad GLT=2000.10^6 Pa$$

the second layer by:

$$EL=15000.10^6 Pa \quad ET=15000.10^6 Pa \quad VLT=0.3 \quad GLT=1500.10^6 Pa$$

the third layer by:

$$EL=20000.10^6 Pa \quad ET=20000.10^6 Pa \quad VLT=0.3 \quad GLT=2000.10^6 Pa$$

and the fourth layer by:

$$EL=15000.10^6 Pa \quad ET=15000.10^6 Pa \quad VLT=0.3 \quad GLT=1500.10^6 Pa$$

1.3 Boundary conditions and loadings

the node $A1$ is clamped:

$$\begin{aligned} dx &= 0. & dy &= 0. & dz &= 0. \\ dRx &= 0. & dRy &= 0. & dRz &= 0. \end{aligned}$$

The node $A2$ is blocked according to the following ddis:

$$dx = 0. \quad dy = 0.$$

One applies a modal force $Fz = -1000.N$ to the node $A3$.

2 Reference solution

2.1 Méthode de calcul used for the reference solution

the reference solution is resulting from the first computation with ASTER with the quadricouche describes in the problem of reference.

2.2 Results of reference

They are made up by the values of the field of displacement DX, DY, DZ, DRX, DRY at the point $A3$ (node NI for ASTER) and to the node $NI0$ of coordinates $(9,2,0)$.

2.3 Uncertainty on the solution

Null, since it is about the same computation carried out by two different ways.

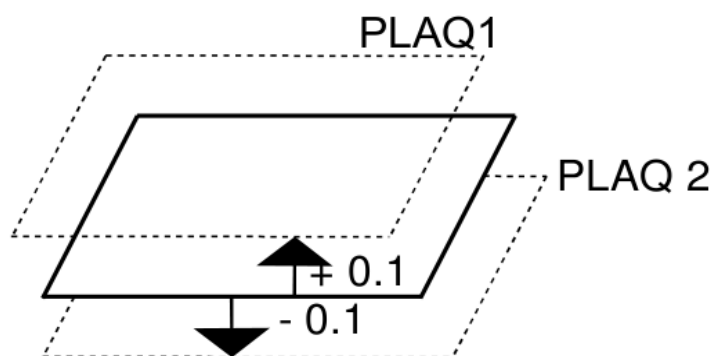
3 Modelization A

3.1 Characteristic of the modelization

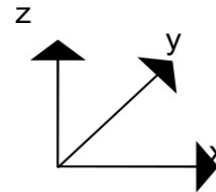
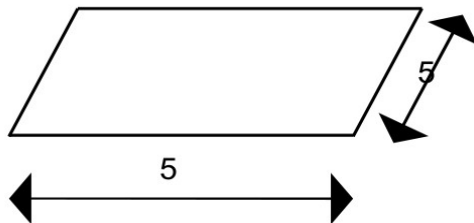
The model consists of 2 double-layered plates corresponding to the average plan of the quadri-layer of the model of reference.

To represent these 2 plates, one leaves the mesh of the average plan of the quadri-layer which one offsets distances -0.1 and 0.1 .

The elements used are shell elements DKT.



3.2 Characteristics of the mesh



The mesh is regular.

There are 10 subdivisions according to x and 5 subdivisions according to y ; that is to say on the whole 50 meshes DKQ (quad4) and 66 nodes.

3.3 Values tested

| Identification | Reference ($\times 10^{-6} m$) |
|----------------|----------------------------------|
| $DX(NI)$ | - 3.680419 |
| $DY(NI)$ | - 0.493941 |
| $DZ(NI)$ | - 5697.7635 |
| $DRX(NI)$ | - 436.1676 |
| $DRY(NI)$ | 508.6670 |
| $DX(NI0)$ | - 2.172360 |
| $DY(NI0)$ | - 0.783905 |
| $DZ(NI0)$ | - 3946.2632 |
| $DRX(NI0)$ | - 412.1209 |
| $DRY(NI0)$ | 455.0638 |

4 Synthesis

the results got with offset multi-layer plates agree with the reference.

This test thus validates the eccentring for the multi-layer plates.