SSLS112 - Offsetting composite plates

Summary:

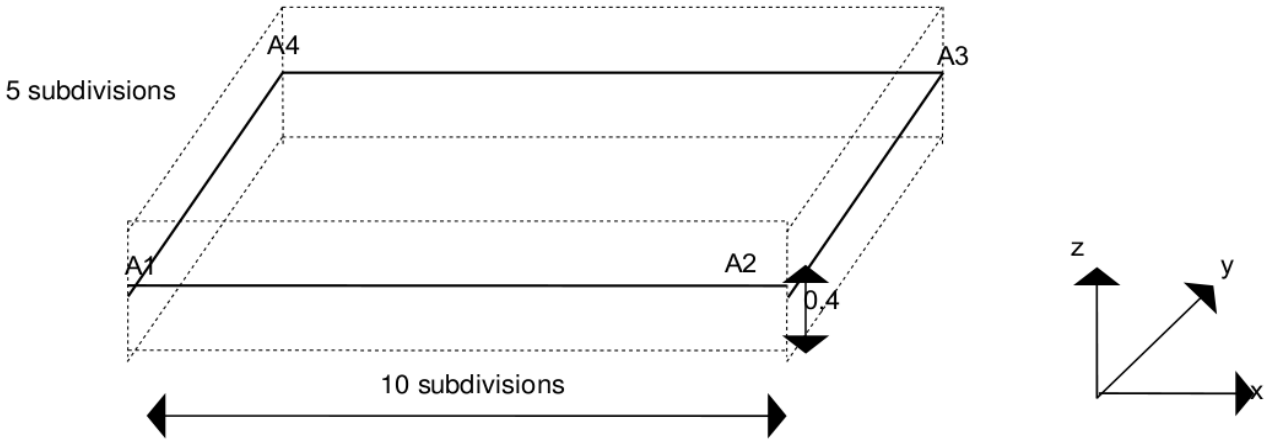
This test makes it possible to validate the offsetting of composite plates.

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

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

1 Problem of reference

1.1 Geometry



coordinates 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 thickness 0.1.

The first layer is characterized by:

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

the second layer by:

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

the third layer by:

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

and the fourth layer by:

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

1.3 Boundary conditions and loadings

The node $A1$ is embedded:

$dx=0.$ $dy=0.$ $dz=0.$

$dRx=0.$ $dRy=0.$ $dRz=0.$

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

$dx=0.$ $dy=0.$

A modal force is applied $Fz=-1000.\mathrm{N}$ on the node $A3$.

2 Reference solution

2.1 Method of calculating used for the reference solution

The reference solution is resulting from the first calculation 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 $N1$ for ASTER) and with the node $N10$ coordinates $(9,2,0)$.

2.3 Uncertainty on the solution

Worthless, since it is about the same calculation carried out by two different ways.

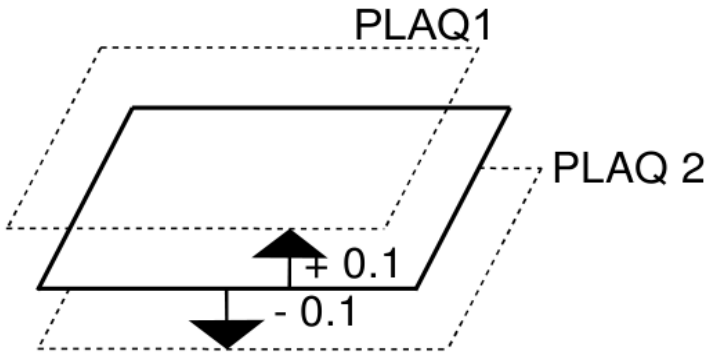
3 Modeling A

3.1 Characteristics of modeling

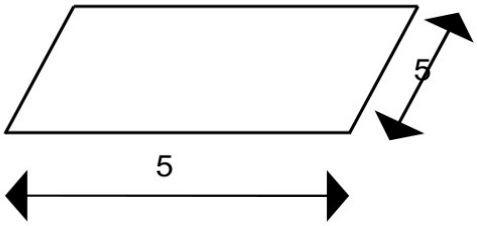
The model consists of 2 double-layered plates corresponding to the average plan of the quadri-layer of the model of reference.

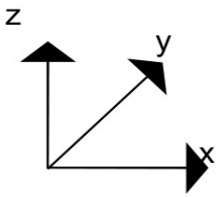
To represent these 2 plates, one leaves the grid of the average plan of the quadri-layer which one offsets distances -0.1 and 0.1 .

The elements used are elements of plate DKT.



3.2 Characteristics of the grid





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

3.3 Values tested

Identification	Reference $(\times 10^{-6} m)$
$DX(N1)$	– 3.680419
$DY(N1)$	– 0.493941
$DZ(N1)$	– 5697.7635
$DRX(N1)$	– 436.1676
$DRY(N1)$	508.6670
$DX(N10)$	– 2.172360
$DY(N10)$	– 0.783905
$DZ(N10)$	– 3946.2632
$DRX(N10)$	–412.1209
$DRY(N10)$	455.0638

4 Synthesis

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

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