

SSNV514 – Stamping of a sheet by a cylindrical punch

Summary:

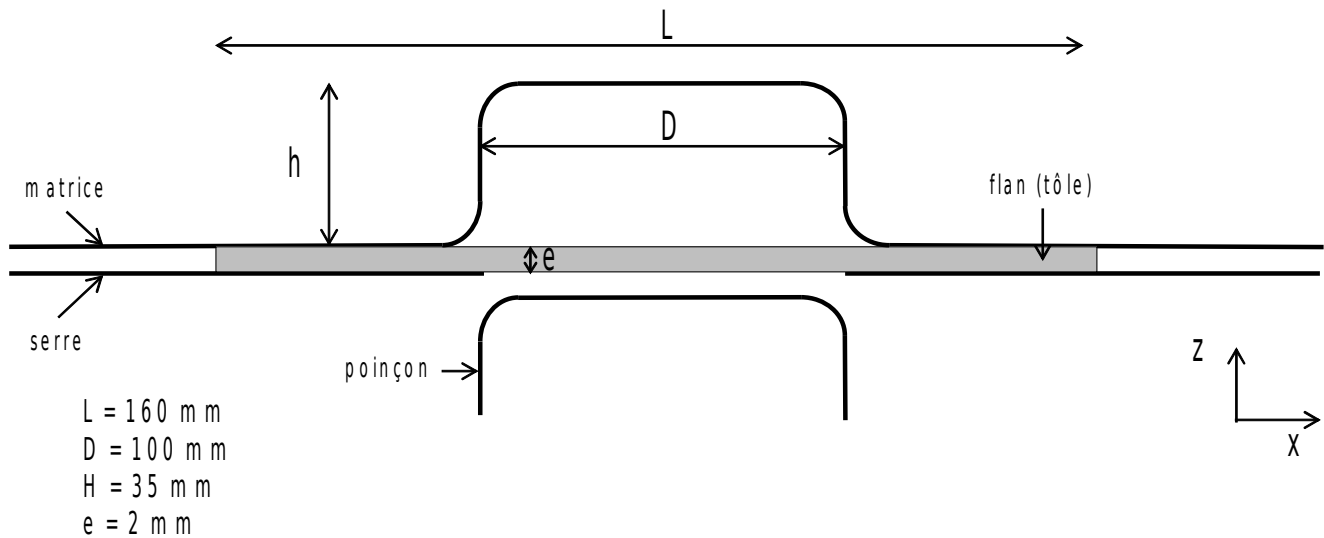
This test represents a calculation of stamping of a square sheet by a rigid cylindrical punch in the presence of great plastic deformations. This test is useful in the simulation of working sheet.

The analyzed results are vertical displacement and the deformations of sheet.

The sheet is modelled in elements 3D (HEXA8). The punch and the die are rigid elements. The contact between the various elements is modelled by a formulation continues (null friction)

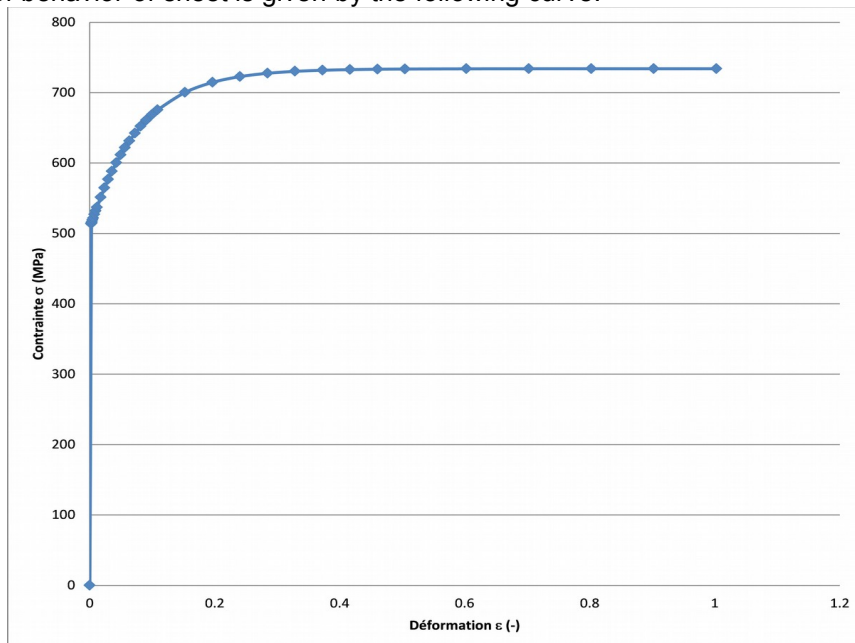
1 Problem of reference

1.1 Geometry



1.2 Properties of material

The law of behavior of sheet is given by the following curve:



The elastic parameters of the answer are:

$$E = 200\,000 \text{ MPa}$$

$$\nu = 0.3$$

Young modulus

Poisson's ratio

1.3 Boundary conditions and loadings

Boundary conditions: - the matrix is embedded
- 4 nodes of sheet are blocked in directions X or Y to remove the movements of rigid body

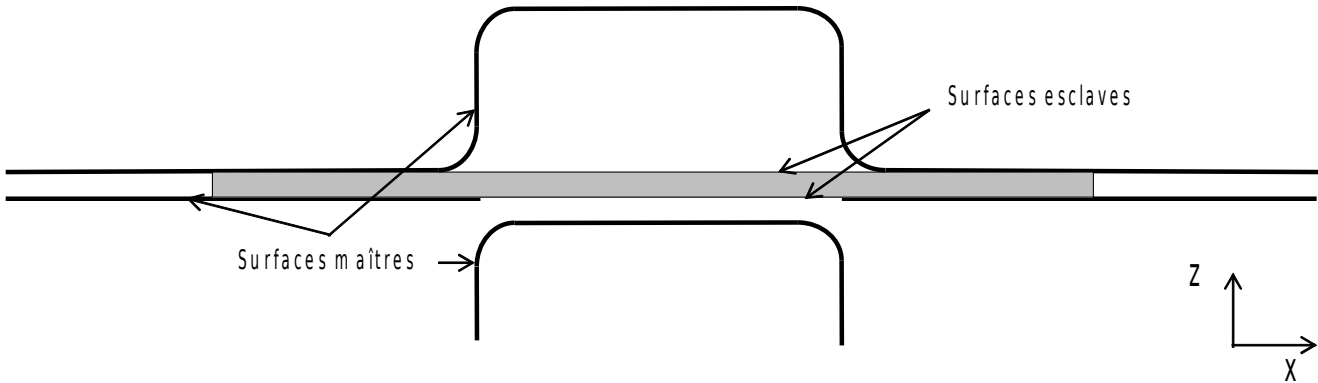
Loading: - vertical force on the blank holder equalizes with 250 MN
- vertical displacement imposed of the punch from 0 to 35 mm

2 Reference solution

There is no reference solution.

3 Modeling A

3.1 Characteristics of modeling



3.2 Characteristics of the grid

Many nodes: 24,248
Many meshes: 3072 QUAD4, 36,896 TRIA3 and 4096 HEXA8

3.3 Characteristics of the grid

One tests the values of horizontal and vertical displacements::

Identification (Displacement)	Node	Inst	Reference	Type of reference	Tolerance
<i>DX</i>	BlankBx_1	1	-14.9363814	'NON_REGRESSION'	0,0001%
<i>DX</i>	BlankBx_1	1	14.5786067	'NON_REGRESSION'	0,0001%
<i>DY</i>	BlankBx_2	1	-14.8289740	'NON_REGRESSION'	0,0001%
<i>DY</i>	BlankBx_2	1	14.7678067	'NON_REGRESSION'	0,0001%
<i>DZ</i>	BlankBz_0	1	31.3676071	'NON_REGRESSION'	0,0001%

One tests the extreme values of the deformations of Green-Lagrange:

Identification (Deformation EPDG)	Extremum	Inst	Reference	Type of reference	Tolerance
<i>EPXX</i>	MAX	1	0.4372544	'NON_REGRESSION'	0,0001%
<i>EPXX</i>	MIN	1	-0.2679884	'NON_REGRESSION'	0,0001%
<i>EPYY</i>	MAX	1	0.4278832	'NON_REGRESSION'	0,0001%
<i>EPYY</i>	MIN	1	-0.2701473	'NON_REGRESSION'	0,0001%
<i>EPZZ</i>	MAX	1	0.1991221	'NON_REGRESSION'	0,0001%
<i>EPZZ</i>	MIN	1	-0.1579055	'NON_REGRESSION'	0,0001%
<i>EPXY</i>	MAX	1	0.4048913	'NON_REGRESSION'	0,0001%
<i>EPXY</i>	MIN	1	-0.3995492	'NON_REGRESSION'	0,0001%
<i>EPXZ</i>	MAX	1	0.1734832	'NON_REGRESSION'	0,0001%

Code_Aster

Version
default

Titre : SSNV514 - Emboutissage d'une tôle par un poinçon c[...]
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<i>EPXZ</i>	MIN	1	-0.1681392	'NON_REGRESSION'	0,0001%
<i>EPYZ</i>	MAX	1	0.1698217	'NON_REGRESSION'	0,0001%
<i>EPYZ</i>	MIN	1	-0.1675692	'NON_REGRESSION'	0,0001%

4 Summary of the results

On the figure below we present, for modeling A, the deformation of the blank, the position of the punch for a vertical displacement of the punch equal to 35mm.

