*CONTROL_FORMING_PRE_BENDING

Purpose: This keyword allows for a pre-bending of an initially flat sheet metal blank, typically used in controlling its gravity loaded shape.

Card Format (I10, 7E10.0)

Card 1	1	2	3	4	5	6	7	8
Variable	PSET	RADIUS	VX	VY	VZ	XC	YC	ZC
Type	I	F	F	F	F	F	F	F
Default	none	none	none	none	none	none	none	none

VARIABLE	DESCRIPTION
PSET	Part set ID to be included in the pre-bending.
RADIUS	Radius of the pre-bending. GT.0.0: bending center is on the same side as the element normals LT.0.0: bending center is on the reverse side of the element normals. See figure below for more information.
VX, VY, VZ	Vector components of an axis about which the flat blank will be bent.
XC, YC, ZC	X, Y, Z coordinates of the center of most-bent location. If undefined, center of gravity of the blank will be used as a default.

Remarks:

1. In some situation, a flat blank upon gravity loading will result in a “concave” shape in a die, referring to figures below. This mostly happens in cases where there is little or no punch support in the middle of the die cavity. Although the gravity loaded blank shape is correct the end result is undesirable. Buckles may result during the ensuing closing and forming simulation. In reality, a true flat blank rarely exists. Typically, the blank is either manipulated (shaking or bending) by die makers in the tryout stage, or by suction cups in a stamping press, to initially have a convex shape prior to the binder closing and punch forming. This keyword allows this bending to be performed.

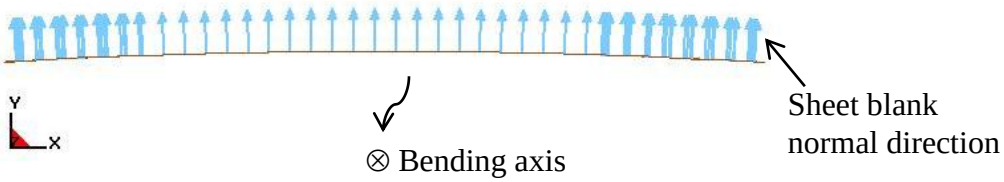
2. A partial keyword example is provided below, where blank part set ID &BLKSID defined previously, was to be bent in a radius value of 10000.0mm, with the bending axis of Z, located on the reverse side of the blank positive normal. The bending is off gravity

center at x=234.0, y= 161.0, z=81.6 (to the right along positive X-axis). Only a slight pre-bending on the blank is needed to ensure a convex gravity-loaded shape.

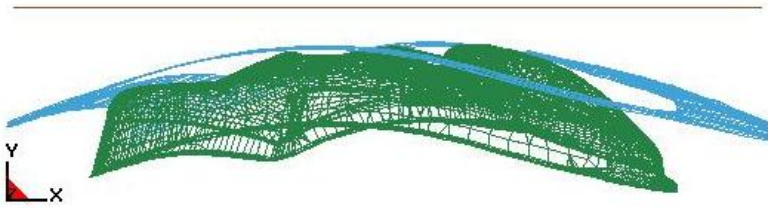
```
*KEYWORD
...
*CONTROL_IMPLICIT_FORMING
1
*CONTROL_FORMING_PRE_BENDING
$      PSET     RADIUS         VX         VY         VZ         XC         YC         ZC
   &BLKSID    -10000.       0.00       0.00        1.0    234.000    161.000      81.60
...
*END
```

In the figures below, gravity-loaded shape without pre-bending and with pre-bending are illustrated.

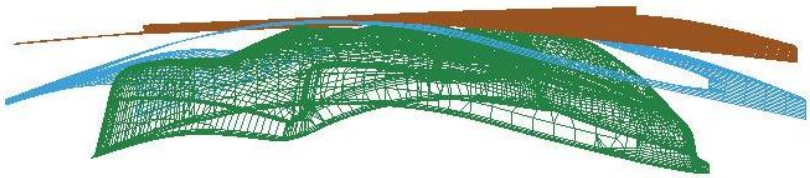
3. This feature is available in LS-DYNA R6 Revision 66094 or later releases.



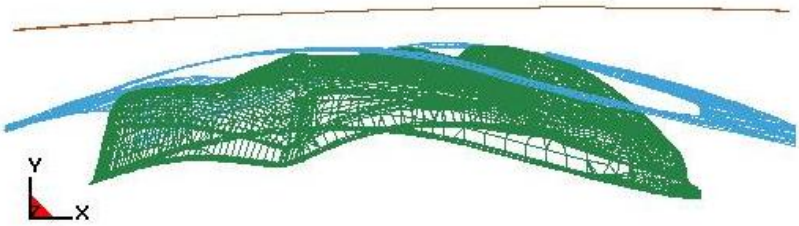
Negative “R” means center of bending is on the opposite side of the positive blank normal



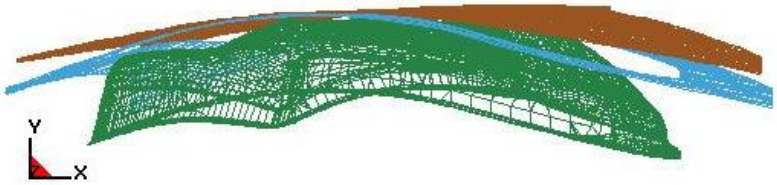
Initial model set up



Gravity loaded blank without using this keyword –
Blank sags in the die cavity (concave shape)



Pre-bending with R=10000.0mm using this keyword (1st state of D3plots)



Gravity loaded shape (last state of D3plots) –
Convex shape blank achieved and binder closing distance reduced

Figure. Pre-bending of a fender outer (*NUMISHEET 2002)*