

# Lancing features in LS-DYNA

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## Introduction

Lancing the blank in the sheet metal forming can be strategically used under controlled conditions to alleviate the thinning and necking of the sheet metal panels. A brief introduction of the lancing features (instant lancing, progressive lancing and the lancing with trimming) in LS-DYNA will be presented as below, along with the Graphical User Interface for the lancing definition in LS-PrePost EZSetup.

## Keywords for the lancing feature in LS-DYNA

To use the lancing feature in LS-DYNA, \*ELEMENT\_LANCING and \*DEFINE\_CURVE\_TRIM\_3D would be needed. In \*ELEMENT\_LANCING, the blank to be lanced (IDPT), the lancing path (IDCV) and the starting time (AT) can be defined. The lancing path can be specified in \*DEFINE\_CURVE\_TRIM\_3D. An excerpt of the keyword is shown as below:

```
*ELEMENT_LANCING
$   IDPT      IDCV      IREFINE      SMIN      AT      ENDT      NTIMES
   &blklpid    90953          1          &at      &endt      &ntimes
*DEFINE_CURVE_TRIM_3D
$#   tcid      tctype      tflg      tdir      tctol      toln      nseed1      nseed2
   90953          1          1          0
$#           cx           cy           cz
   -3.253909e+001      8.811000e+000      3.907000e+001
   -3.288404e+001      8.831327e+000      3.907000e+001
.....
```

If the ending time (ET) is left blank, the instant lancing will be performed; otherwise the progressive lancing will be performed. The cutting times in this process can be further defined by specifying the NTIMES.

If the lancing is followed by the trimming process, the remaining zone in the blank can be specified in \*DEFINE\_LANCE\_SEED\_POINT\_COORDINATE, as show below:

```
*DEFINE_LANCE_SEED_POINT_COORDINATES
$#   NSEED      X1      Y1      Z1      X2      Y2      Z2
   1      -50.6727      19.58      39.07
```

More details and the examples of the lancing feature can be found in the LS-DYNA Keyword User's Manual Vol.1.

It should be emphasized that the adaptivity (\*CONTROL\_ADAPTIVE) of the blank mesh should always be enabled in the lancing simulation.

## The Graphical User Interface for the lancing setup

To simplify setting up the lancing process in LS-DYNA, the graphical user interface (GUI) is implemented in LS-PrePost EZSetup. The lancing process can be defined in the Punch page of the Forming in the EZSetup, as shown in Fig. 1.

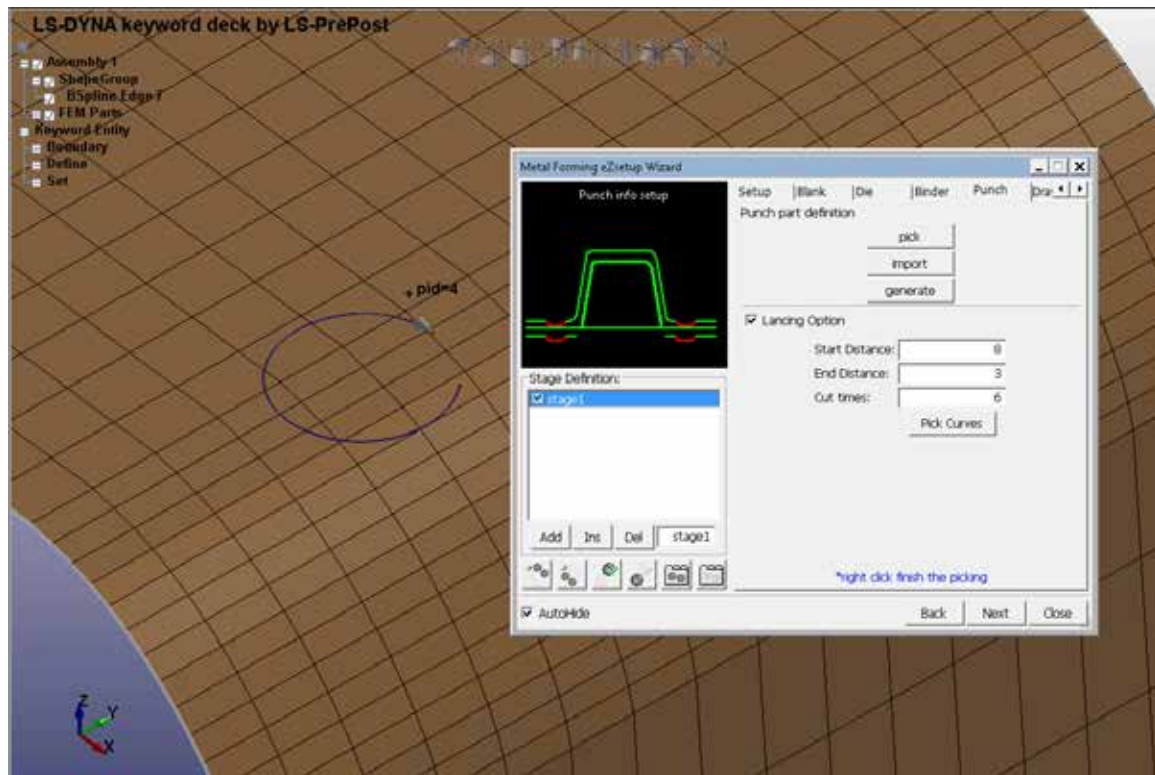


Fig. 1 the lancing setup in LS-PrePost EZSetup

For the instant lancing, the path can be defined by picking the curve in the IGES format in LS-PrePost. Instead of specifying the starting time, the distance to the tool home position is used in EZSetup to specify the starting of the lancing process. The corresponding keywords will be generated by EZSetup in the inputdeck of the forming process..

For the progressive lancing, the End Distance and the Cut Times would be further needed. As shown in Fig. 1, the direction of the lancing path can also be previewed in the main window. If necessary, the lancing direction can be reversed via LS-PrePost: GeoTol->Rever. Setting up the lancing with trimming would be supported in the later version of LS-PrePost EZSetup.

Currently for simulation of the lancing with trimming, manual modification of the generated keyword file would be necessary to include the following keyword as mentioned above: \*DEFINE\_LANCE\_SEED\_POINT\_COORDINATES.

## Examples of the lancing simulations

An example of the instant lancing with trimming is given in Fig.3. The blank is lanced and trimmed when the upper tool is at 5mm to the home position,. Fig.4 shows a progressive lancing process, in which the blank is lanced when the upper tool is moving from 8mm to 2mm until its home position.

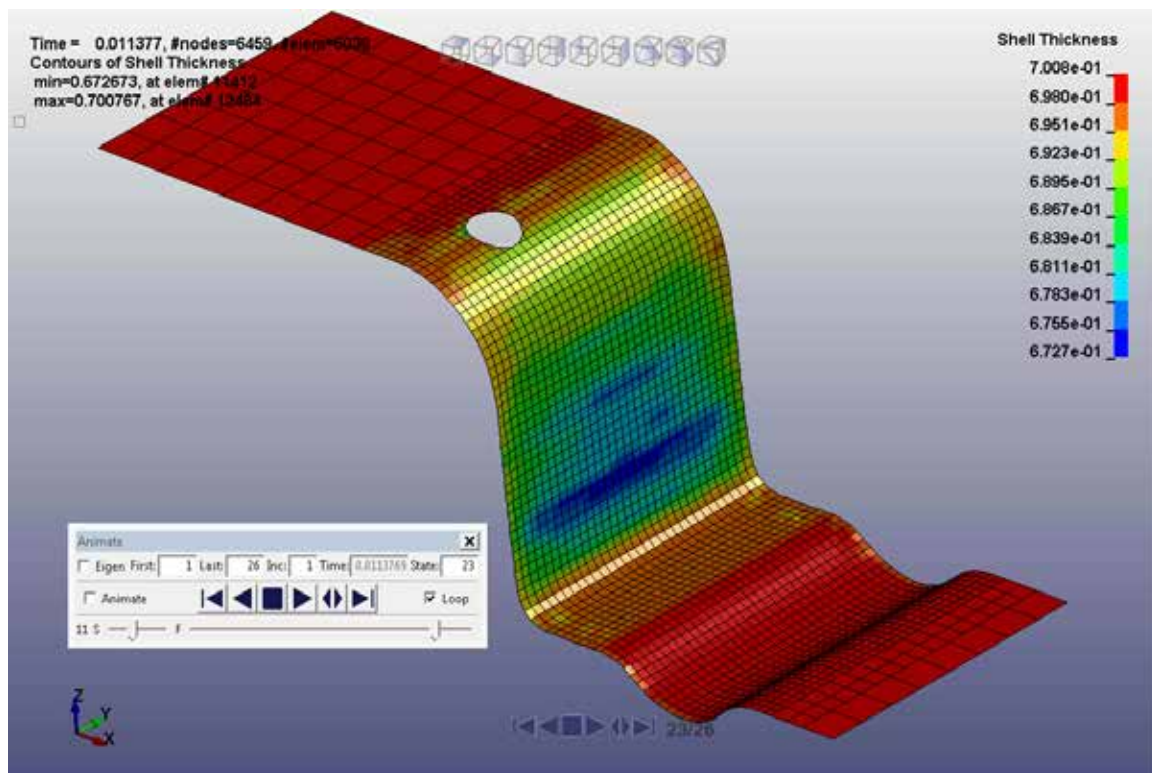


Fig. 3 the instant lancing with trimming

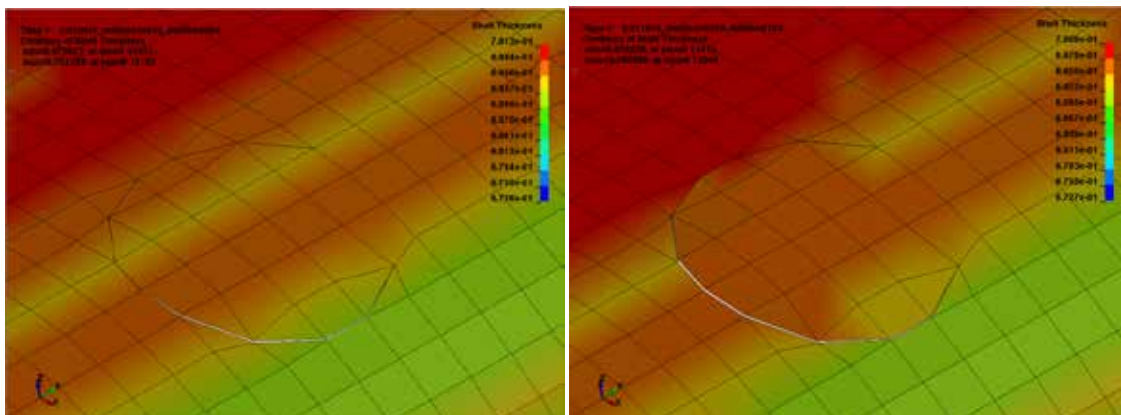


Fig.4 the progressive lancing

## **Revisions**

The lancing feature in LS-DYNA is available starting in Revision 83562 for SMP, and Revision 94383 for MPP. For lancing with trimming, Revision 107262 or later is required. The newest beta solver is recommended due to the continuous improvements. The GUI of lancing setup can be found in LS-PrePost 4.3 -> Applications -> Metal Forming: EZSetup

## **Summary**

The keywords for the lancing feature of LS-DYNA, and the setting up via the GUI in LS-PrePost EZSetup, were briefly presented. With the lancing feature, the capability of the LS-DYNA in simulating the metal forming is further enhanced. The GUI in LS-PrePost EZSetup would efficiently help the users set up the lancing process in a straightforward manner.