R12.2.2 Release Notes

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1 Release notes revision

This file constitutes revision 0 of the release notes for LS-DYNA version R12.2.2.

2 License

The string "REVISION 12" must appear in the LS-DYNA license file to run version R12.2.2. Please contact your LS-DYNA distributor or your Ansys sales representative if you need to have your license updated.

3 Documentation

The R12.0 User's Manuals provide documentation for R12.2.2. To download these manuals, go to https://lsdyna.ansys.com/manuals/. For features mentioned in these notes missing from the R12.0 User's Manuals, please refer to the the DRAFT User's Manuals at https://lsdyna.ansys.com/manuals/. Not all features mentioned in the DRAFT User's Manual are available in R12.2.2.

4 Notes

The remainder of this file briefly describes enhancements and bug fixes in version R12.2.2. Other recent releases may also include some of these updates.

We arranged the items by category. Understand that, in many cases, a particular item may pertain to more

than one category. In the interest of brevity, we list each item only once, under a single category.

5 Improvements and Enhancements

5.1 Airbags

1. Added tracking CPM particles leaking out from a failed element (control volume without closed volume) and switched them to a different deactivated group. This tracking improves the efficiency of the particle-to-fabric bucket sort. This leak is reported to abstat_cpm under airbag dm_out_dt.

2. Improved the behavior for determining the pressure difference for PPOP on *AIRBAG_PARICLE. Previously, before reaching the pop pressure, the part pressure of the vent was zero. The algorithm determining the pressure difference for PPOP then depended on how the airbag was modeled. If an additional part was included near the vent, the part pressure of that part was used. If not, the algorithm looked to see if a chamber was defined to determine the pressure at the vent. If neither a chamber nor an additional part was defined, a noisy model was used to determine the pressure at the vent. With this improvement, the pressure of the vent part is calculated in the same way as a regular part before reaching the pop pressure without requiring an additional part. This algorithm has increased accuracy compared to not including an additional part or chamber. It also no longer requires an additional part or a chamber. Chamber definitions are now ignored, but additional parts are still used.

3. Added options JETLEN and JETEND to *AIRBAG_PARTICLE to improve deployment kinematics.

5.2 Contact

1. Added an option to improve the consistency of MPP contact handling that ensures the contacts are always processed in the same order, independent of the order in which they appear in the input. This order independence only works properly if all contacts have user-assigned IDs, in which case changing the input order should not affect the processing order. If one or more contacts are missing user IDs, changing the input order can still affect the processing order.

   This behavior is OPTIONAL before R15 (where it is always enabled) and disabled by default. To enable this feature, add the control card *CONTROL_MPP_DECOMPOSITION_CONTACT_SORT anywhere in the input deck, or add this line to the pfile: `decomp { contact_sort }`.

2. Improved the diagnostic messages during MPP initialization of groupable tied contacts.

3. Modified the segment-based (SOFT = 2) contact bucket sort to reject segment pairs when a solid segment very deeply penetrates a shell segment. This issue caused spurious contact forces and problems with penetration warnings.

4. Improved the accuracy of the initial penetration and periodic intersection checking of segment-based (SOFT = 2) contacts.

5. Added DIR_TIE on *CONTROL_CONTACT to enable a “directional tie” when a solid element is tied to its surroundings. With this option, solid nodes are preferentially tied in the direction of the outward normal to avoid a collapse of the solid elements to zero volume.

5.3 Control Cards

1. Added option CRVP to *CONTROL_SOLUTION. Activating this field causes bypassing time-based evaluation of non-time-dependent curves, such as stress-strain curves for materials. This feature can improve CPU performance when many curves are used (such as from a big material database) in smaller models.

5.4 Forming Analysis

1. Added optional check for the correct material type of the target to *INCLUDE_STAMPED_PART with field MTYPE. MTYPE provides the expected material type of the target part. If MTYPE does not match

the material type of the target part, an error is thrown. It is useful if history variables are mapped to avoid an unintended change of material type.

5.5 Initial Cards

1. Allow the initialization of history variables based on nodes (*INITIAL_HISTORY_NODE(_SET)) for the case that the same node is part of various definitions of node set. For instance, if a node is part of two node sets where the history variable #5 is initialized for the first node set and history variable #7 is initialized for the second, both history variables are now initialized for the node.

5.6 Materials and Equations-of-State

1. Add option LCSOFT to *MAT_ADD_DAMAGE_GISSMO. This field references a load curve or table ID. A curve gives the soft reduction factor as a function of triaxiality. A table specifies the soft reduction factor as a function of triaxiality and element size. Like for SOFT, the sign of LCSOFT determines which strains are scaled by the factor.

2. Added new option to *MAT_ADD_DAMAGE_GISSMO for triaxiality-dependent regularization. Two new triaxiality values, RGTR1 and RGTR2, between 0 (shear) and 2/3 (biaxial) together with SHRF = 1 and BIAXF = 1 describe a trapezoidal tub-shaped regularization. This would already be possible with LCREGD < 0, but the new approach is faster.

3. Enabled part-wise definition of the nonlocal energy criterion of *MAT_ADD_EROSION and *MAT_-280. This enhancement relates to the input parameters ENGCRT and RADCRT that exist for both materials. Up to now, only one global energy value could be defined (see Remark 1i in *MAT_ADD_-EROSION for details). Now, the definition in each material card is taken into account separately.

4. For *MAT_FABRIC_MAP (*MAT_034_M), converted a warning into an error when LS-DYNA cannot compute the fiber vectors from user specifications because this material is always anisotropic.

5. Improved the viscoplastic algorithm in *MAT_063 for MODEL $\geq$ 1. This change affects RFILTF = 0. Brent's method is used to avoid non-convergence.

6. Added new option to *MAT_063 with MODEL = 1 or 2. LCID can now refer to a *DEFINE_TABLE_3D to make the yield stress a function of strain (CURVE), strain rate (TABLE), and value of history variable #8 (TABLE_3D). History variable #8 can be set with *INITIAL_STRESS_SOLID or *INITIAL_HIS-TORY_NODE. This feature can be used to model foam with spatially varying porosity/density.

7. Improved the speed of the strain rate algorithm for viscoplasticity of *MAT_BARLAT_YLD2000 (*MAT_133) for certain choices of input.

5.7 Output

1. For shells, write the parameter NLOC from *SECTION_SHELL to hisnames.xml. See HISNOUT on *CONTROL_OUTPUT.

2. Output the titles of *DEFINE_CURVE_FUNCTION to curvout for LS-PrePost.

5.8 Miscellaneous

1. Fixed MPP support for part numbers greater than five digits in *DEFORMABLE_TO_RIGID_AUTO-MATIC.

6 Bug Fixes

6.1 Airbags

1. Properly support inputting inflator mass flow rate using a total mass flow rate curve and species-based

mole fractions for IAIR = 2 and 4 on *AIRBAG_PARTICLE with the MOLEFRACTION keyword option.

2. Fixed parameter input in *AIRBAG_SHELL_REFERENCE_GEOMETRY. The bug resulted in the following error message: `Error 10246 (KEY+246) line contains improperly formatted data reading *AIRBAG_SHELL_REFERENCE_GEOMETRY card.`

6.2 Constraint Cards

1. Fixed bug for SPOTHIN on *CONTROL_CONTACT when applied to *CONSTRAINED_INTERPOLATION_SPOTWELD (SPR3). MPP synchronization was missing for scaled contact thickness.

2. Fix for internal energy computation in *CONSTRAINED_SPR2 to avoid nonsensical results when damage reaches 1.

6.3 Contact

1. Fixed warning message for nodes not being tied in MPP for tied contact. In some cases where this message should have been written to the messag file:

   ```
   *** Warning 50129 (MPP+129)
       Tracked node is not constrained
       since it is not found on a segment.
   ```

   a message like this was being issued with garbage values for the connectivity:

   ```
   *** Warning 50146 (MPP+146)
       segment contains rigid body nodes
   ```

   This was due to an improperly initialized array, which has been fixed.

2. Fixed a conflict between *CONTACT_EXCLUDE_INTERACTION and the thick segment pair check in MPP segment-based (SOFT = 2) contact. The conflict caused the exclusion of the wrong segment pairs.

3. Fixed issue with releasing scratch memory used in the initialization routines for contacts, causing large memory usage.

6.4 Control Cards

1. Fixed incorrect mass output for selective mass scaling.

6.5 Elements

1. Corrected the contact stiffness with solid tetrahedral form 60 for segment-based (SOFT = 2) contact.

2. The combination of using *ELEMENT_T/SHELL_COMPOSITE and *CONSTRAINED_NODAL_RIGID_BODY may have introduced some incorrect evaluation of part sets and thus led to unexpected results.

3. Fixed a problem that may have appeared when a model contains a very large number of *ELEMENT_T/SHELL_COMPOSITE keywords while using *INITIAL_VELOCITY_GENERATION for these elements. Running such models may have led to unexpected errors due to very large part IDs in newly automatically generated parts within LS-DYNA.

4. Fixed issue with mass scaling of cohesive solids (*SECTION_SOLID with ELFORM = 19 through 22). Inverted elements (negative volume) could lead to a huge negative added mass. Replacing the current volume by the initial volume fixes this issue.

5. Fixed shell thickness update with PSTUPD on *CONTROL_SHELL. This feature has not been working properly for ELFORM = 16 since May 2021 (R14 releases).

6. Fixed issue with *DEFINE_SD_ORIENTATION. In large models (>16.8 million nodes), it was possible that the internal node IDs of NID1 and NID2 were the same, leading to error STR+509 (`orientation`

vector 8: nodes are coincident).

7. Fix for I10 format input with *ELEMENT_SEATBELT. Parameter N4 was not interpreted correctly.
8. Fixed erratic behavior when using pentahedral cohesive elements, ELFORM = 21 and 22 on *SECTION_SOLID.

6.6 Forming Analysis

1. Fixed bug in *INCLUDE_STAMPED_PART when reading *INITIAL_STRAIN_SHELL from the dynain file when the dynain file is in the large format.

6.7 Implicit (Mechanical) Solver

1. Fixed bug in nonlinear implicit analysis for *CONSTRAINED_INTERPOLATION (RBE3) due to an issue with the synchronization of data for a large number RBE3s.

6.8 Materials and Equations-of-State

1. Fix for *MAT_ADD_DAMAGE_DIEM. Do not extrapolate in strain rate tables (2D) given by P1.
2. Fix for *MAT_ADD_DAMAGE_GISSMO. Damage is driven by plastic strain (DTYP = 0 or 1) or a history variable (DTYP ≥ 10). If that history variable is not monotonically increasing (plastic strain always is), damage could grow even below the already-reached maximum value. This behavior is now prevented by remembering that maximum value. See also IFLG4 = 1 on *MAT_ADD_GENERALIZED_DAMAGE.
3. Fix for *MAT_ADD_DAMAGE_GISSMO with shell elements type 13, 14, and 15. Element IDs in failure reports were wrong (just zero).
4. Fixed issue for *MAT_024_STOCHASTIC where VP = 1, LCSS is a table, and the element kind is shell elements. Scaling of the yield stress could have been wrong.
5. For *MAT_030:
   - Fixed bugs in the plasticity algorithm that could cause an incorrect solution and result in unphysical time step size dependencies for shell elements when using LCID_AS and LCID_SA.
   - Improved the convergence behavior for strain-rate-dependent plasticity. This fix can prevent floating point exceptions seen in certain models.
6. For *MAT_LAMINATED_COMPOSITE_FABRIC (*MAT_058), fixed bug in the table evaluation of EA, EB, or GAB < 0 for shell elements. Prior to this fix, the table may not have been evaluated correctly by not using the correct load curve associated with a specific strain rate.
7. For shell elements using *MAT_LAMINATED_COMPOSITE_FABRIC, (*MAT_058), use initial, undamaged stiffness to compute the sound speed/time step.
8. Fixed bug in implicit for *MAT_063 with MODEL = 1 or 2. A segmentation fault was likely to happen.
9. For *MAT_GENERAL_JOINT_DISCRETE_BEAM, fixed the positioning of the history variables for neighboring parts and failure. These could become offset, such as when using *DEFINE_MATERIAL_HISTORIES.
10. Fix for the internal energy computation in *MAT_123 with VP = 1 and tetrahedral solids of ELFORM 13. Energy could have been wrong (e.g., negative) if all elements in a vector block were elastic.
11. For *MAT_MODIFIED_PIECEWISE_LINEAR_PLASTICITY (*MAT_123), fixed erroneous internal energy calculations.
12. Fixed issue for *MAT_124 if a huge number of curves (> 9999) is used in a model. This bug could lead to an error or the material using the wrong curve.
13. For *MAT_LAMINATED_FRACTURED_DAIMLER_CAMANHO (*MAT_262), fixed bug in the table evaluation of EA, EB, or GAB < 0 for shell elements. Prior to this fix, the table may not have been

evaluated correctly by not using the correct load curve associated with a specific strain rate.

14. For shell elements using *MAT_LAMINATED_FRACTURED_DAIMLER_CAMANHO (*MAT_262), use initial, undamaged stiffness to compute the sound speed/time step.

15. Fixed issue for *MAT_280 with RATENL > 0 or FT < 0 to avoid negative strain rates.

6.9 Sensors

1. Fixed a bug for *SENSOR_DEFINE_FORCE that happened when TYPE = JOINT and the input deck contains more than one joint definition. The bug could cause the sensed result to depend on the joint definition sequence.

6.10 User-Defined Features

1. Fixed issue with *USER_INTERFACE_FRICTION. Determining element history variables could be wrong if triangular shell elements were involved. Also, a large number of history variables were not taken care of correctly.

6.11 Miscellaneous

1. Fixed reinitialization issue with the flag that controls the output of the “relax” file during dynamic relaxation. It was not properly set up for *CASE support, so only the first *CASE having dynamic relaxation was writing this file.

2. Fixed keyword memory error with *SET_SEGMENT_GENERAL and solid elements. The error could happen during the keyword reading phase (`Segment set ID ... is a null set ...`).

3. For certain combinations of *SET options, fixed bugs in the reallocation of memory structures that caused segmentation violations in these situations.

4. Support *DEFORMABLE_TO_RIGID with consistent mass scaling (RBSMS = 1 on *CONTROL_-RIGID). This combination previously resulted in erroneous behavior.