BEST PRACTICES - LS-DYNA
MPP - DECOMPOSITION

- Recursive Coordinate Bisection (RCB).
Use Decomposition transformation.
_DECOMPOSITION_CONTACT_DISTRIBUTION_

- Default Decomposition
- With Decomposition Transformation
- + Decomposition Contact Distribute
GROUPABLE algorithm is an alternate MPP communication algorithm for various single surface, nodes_to_surface, surface_to_surface, ERODING, and option SOFT = 2 contacts.
CONTROL_MPP_DECOMPOSITION_BAGREF – will perform decomposition according to the airbag’s reference geometry, rather than the folded geometry.
CPU Binding or CPU affinity

CPU binding will improve the performance of many applications by binding a process to a particular CPU.
Spotting the non-default values used

To make things easy for debugging, preferably leave the variable for those which are using LS-DYNA defaults as zero or as blank.

```plaintext
$ *CONTROL SHELL
$: wrpang esort irnxx istupd theory bwc miter proj
  20.0  1  -1  4  2  2  1  0
$: rotascl intgrd lamsht cstyp6 thshel
  1.0  0  0  1  0
$: psstupd sidt4tu cntco itsflg irquad w-mode stretch icrq
   0  0  0  0  0  2  0.0  0.0  0
$: nfail1 nfail4 psnfail keepcs delfr drcpsid drcprm intperr
   1  1  0  0  0  0  0  1.0  0
$

$ *CONTROL SHELL
$: wrpang esort irnxx istupd theory bwc miter proj
   0.0  1  0  4  0  0  0  0
$: rotascl intgrd lamsht cstyp6 thshel
   0.0  0  0  0  0
$: psstupd sidt4tu cntco itsflg irquad w-mode stretch icrq
   0  0  0  0  0  0  0.0  0.0  0
$: nfail1 nfail4 psnfail keepcs delfr drcpsid drcprm intperr
   1  1  0  0  0  0  0  0.0  0
$
```
CONTROL_ACCURACY

- OSU = 1 – Invokes 2\textsuperscript{nd} order objective stress.
- PIDOSU > 0 – Part set ID for objective stress updates.
CONTROL_ACCURACY...

- INN = 4 – Invariant node numbering.

In-plane shear loading for shells
CONTROL_BULK_VISCOSITY

TYPE = -2 – Internal energy dissipated by the viscosity in the shell elements is computed and included in the overall energy balance.
CONTROL_CONTACT

- RWPNAL < 0.0 (= −1.0) – Nodes of the rigid bodies as well the deformable bodies that are interacting with rigid walls are treated by the penalty method.
CONTROL_CONTACT...

- SSTHK = 1 – Uses the contact thickness equal to the shell thickness. Not applicable for SOFT = 2.
CONTROL_CONTACT...

- IGNORE = 2 – allows ‘initial’ penetrations to exist by tracking the initial penetrations. Penetration warning messages are printed with the original coordinates and the recommended coordinates of each slave node.

Minimum gap between two mid-plane shell meshes should be at least 90% of the average of the parent panels.
CONTROL_CONTACT...

(SPOTSTP = 2) – when spotweld beam nodes or solid element faces cannot find master surfaces, print a message, delete such welds and continue with calculation.
CONTROL_CONTACT...

🔹 SPOTDEL = 1 – the beam or solid spotweld is deleted and the tied constraint is removed when the parent shells attached on one side of the spotweld element erodes.
**CONTROL_CONTACT**…

- **SPOTHIN = 0.5** – the thickness of the spotwelded parts are scaled in the vicinity of the spotweld so that the contact forces do not develop between these parts, which would otherwise lead to tensile forces in the spotwelds and their premature failure.
CONTACT_CONTACT...

¬ SHLEDG = 1 – Shell edges are assumed square and flush with the nodes.
CONTROL>Contact…

- FTALL = 1 – Output the contact force data to RCFORC for all the forces transducers that match.
CONTROL_CPM

- CPMOUT = 21 – full CPM database written in more efficient version 4 format.
CONTROL_CPM...

NP2P = 1 – No. of cycles for repartition particle among processors.
CONTROL_CPM...

CPMERR = 1 – Enables error checking for airbag integrity, chamber integrity & inconsistent orientation between the shell reference geometry and FEM shell connectivity. If any problems are detected LS-DYNA will either error terminate the job or try to fix the problem.
CONTROL_ENERGY

- HGEN = 2 – Hourglass energy is computed and included in the energy balance.
- SLNTEN = 2 – Sliding interface energy or contact energy is computed and included in the energy balance.
CONTROL_HOURGLASS

- High velocity deformations – Viscous hourglass control.
- Low velocity deformations – Stiffness hourglass control.
- IHQ = 8 – for type 16 shells.
CONTROL_OUTPUT

NPOPT = 1 & NEECHO = 3 – would suppress the output of the nodal coordinates and element topology info to the d3hsp.
CONTROL_SHELL

ESORT > 0 (=1) – Sorts triangular shells and switches the degenerated quadrilateral shells to more suitable triangular shell formulations.
CONTROL_SHELL...

ISTUPD = 4 & PSTUPD > 0 – Instead of using the total strain, the shell thickness update is carried out using plastic strains.
CONTROL_SHELL...

NFAIL1 = 1 & NFAIL4 = 1 – Checks for highly distorted under-integrated and fully-integrated shells respectively, prints message and deletes such elements.
CONTROL_SOLID

ESORT > 0 (=2) – Sorts tetrahedral and pentahedral solids and switches the degenerated hexahedrons to more suitable tetrahedral and pentahedral formulations respectively.
CONTROL_TIMESTEP

- **DT2MS < 0** – Add mass to an element if and only if an element’s timestep is less than |DT2MS|.
- **IMSCL < 0** - |IMSCL| is the part set ID of the parts for which the selective mass scaling. All other parts in the model are mass scaled the usual way.
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