

Release Note

///AMLS
Automated
MultiLevelSubstructuring
Version 5.0r257

June 12, 2015



Issues addressed in 5.0.r257:

Version 5.0.r257 addresses issues in these categories:

1. Mechanism issue.
2. Phase 5 memory estimation error.
3. Delivery database (DDB) issues.

1: Mechanism issue

“Rigid body modes” of the structure as a whole are typically encountered when phase 3 has worked its way from the “leaves” of the substructure tree, and has arrived at the “root”, where motion of the whole structure is represented. Often a “mechanism”, which is a rigid body mode involving motion of only a portion of the structure, is encountered in phase 3 before reaching the “root” of the tree.

It is beneficial to process all rigid body modes at the same time, so when a mechanism is encountered, AMLS (starting with version 5.0) identifies a node/grid point associated with the mechanism, and postpones processing that node/grid point until the structure as a whole is considered. AMLS writes a message to the log file like this:

```
AMLS Phase3 has begun.
```

```
Before considering behavior of the structure as a whole, AMLS has discovered that at least one vector "x" exists whose associated stiffness (x' K x) is very small, but whose associated mass (x' M x) is not negligible. This is characteristic of a "mechanism": a "rigid body mode" that involves motion of only a portion of the structure.
```

```
AMLS has postponed processing the following nodes/grids until it considers behavior of the structure as a whole, so that all "rigid body modes" can be handled together:
```

```
Node/grid number      key degree of freedom
    3597208             4 of 6
    3532331             6 of 6
```

Recently a few very unusual cases have been discovered in which postponing the processing of one node/grid point alters the substructure tree in ways that phase 4 cannot accommodate. In version 5.0.r246,



this results in job failure with an error message like this one:

```
*****Error in Phase 4a*****  
Type: I/O Error  
Error: read failed to read in all it was required to  
Function: binary_file::get()  
File: md_data  
*****
```

Fix:

For version 5.0.r246, this problem can be addressed by manually forcing the identified nodes/grid points to be postponed by adding the following two lines to the Case Control section of the input data, above all subcases:

```
SET 777 = 3532331, 3597208  
DATAREC = 777
```

The preferable approach is to use version 5.0.r257, which has been fixed so that if a mechanism is encountered, AMLS automatically checks to see whether this is one of the very rare cases in which postponing processing of the selected nodes/grids would cause failure in phase 4.

If not (as is almost always the case), a message is written to the log file like the one shown on the preceding page, and the job completes successfully.

If so, execution of phase 3 is halted and the job reruns phases 2 and 3 with the substructure tree redefined appropriately. The message printed to the log file looks like this:

```
AMLS Phase3 has begun.
```

```
Before considering behavior of the structure as a whole, AMLS has discovered that at least one vector "x" exists whose associated stiffness (x' K x) is very small, but whose associated mass (x' M x) is not negligible. This is characteristic of a "mechanism": a "rigid body mode" that involves motion of only a portion of the structure.
```

```
When this happens, AMLS ordinarily identifies one node/grid associated with each "mechanism" and postpones processing it until it considers behavior of the structure as a whole, so that all "rigid body modes" can be handled together. However, in this very unusual case, AMLS found that
```



postponing the processing of the selected node(s)/grid(s) necessitates running AMLS again from the beginning of phase 2. AMLS postponed processing the following nodes/grids:

Node/grid number	key degree of freedom
3597208	4 of 6
3532331	6 of 6

In future analysis of this model, it will not be necessary for AMLS to wait to discover this problem again in phase 3 and then go back to the beginning of phase 2, if the nodes/grids listed above are identified in the input data.

If AMLS is being used with Nastran, this can be accomplished by creating a SET containing these grids in the Case Control section and setting DATAREC equal to the SET's setid. If the setid is chosen to be 98765, for example, insert these lines in the Case Control section before any subcases:

```
set 98765=12345,45678  <-- write node number(s) again here
DATAREC=98765
```

Contact mladen.chargin@cdh-ag.com, if necessary, for additional assistance.

AMLS Phase3 finished at:	2015 Apr 28 12:24:01
Elapsed time (sec) for Phase 3:	741.831

Second AMLS Phase2 run has begun.

As this message explains, the time spent rerunning phase 2 and part of phase 3 can be avoided in future runs by modifying the input data as the message describes. This modification is the same as described earlier for avoiding the problem using version 5.0.r246. Again, for this example, this is accomplished by adding the following two lines to the Case Control input data, above all subcases:

```
SET 777 = 3532331, 3597208
DATAREC = 777
```

2: Phase 5 memory estimation error

Phase 5 may fail with the following message:

```
*****Error in AMLS Phase5*****
Error: unable to find requested space in work_item
Function: work_item::get_space(bytelength)
*****
```



This is caused by a phase 5 memory estimation error that occurs when transforming unusually large “aux” (i.e., area matrix) data in modal coordinates.

Fix:

The memory estimation error in phase 5 has been corrected.

3: Delivery database (DDB) issues

MSC and NX Delivery Data Bases (DDB):

The following DDBs are stored on the CDH AMLS FTP site:

MSC 2010.1.3, 2011, 2012.1, 2012.2, 2013.1, 2013.1.1, 2014, and
NX8.5, NX9.0, NX9.1, NX10.

If there is a special need for an older DDB version, please contact:

support@cdh-ag.com.

The following items were changed in both the MSC and NX DDBs.

1. In previous DDBs, the RESVEC(NODYNRSP) option did not work properly and could give wrong results. This option eliminates the dynamic response of residual flexibility eigenvectors. Its use is beneficial only in transient response when the structure has rigid body modes. This option has been fixed.
2. Since the beginning of AMLS, MASS normalization has been the only option for eigenvectors. A few DDB releases ago, the MAX normalization option was added. However, it produced incorrect results in some cases. This has now been fixed. It is still recommended that the user specify MASS, because using MAX requires additional computation, and because FastFRS cannot currently be used with MAX. Future versions of FastFRS are expected to have this capability.
3. In some rare cases when the user requested ODS (Operational



Deformed Shapes) some of the displacements were returned as 0 (zero). This has now been fixed.

4. Parameter RESVECB that applies only to Nastran/AMLS has been removed because when users compared standard Nastran results with Nastran/AMLS there were some differences. These differences occurred because the default option for RESVEC in Case Control is RESVEC(DAMP) whereas in the case of Nastran/AMLS the user had to specify *param, resvecb, yes* since the RESVEC(DAMP) was disabled.

The main motivation for creating parameter *resvecb* was for viscous dampers expressed in terms of critical damping in modal tire models. Note that these dampers do not represent physical dampers. When using the default RESVEC(DAMP) option, residual vectors associated with these dampers were automatically generated, but these residual vectors could lead to numerical difficulties.

The best solution for this problem is to convert the viscous dampers for the CELAS elements representing tire modal stiffness to structural damping. The procedure for accomplishing this is described in Section 5 of the CDH/FastFRS User Guide.

5. This item relates only to NX. The RVEL and DAMP options for the Case Control command RESVEC now work correctly.
6. This item relates only to MSC. In the previous release of the DDB CDH corrected a mistake in the standard MSC DDB that appeared when CAABSF elements were used and the user specified *param, g*. The standard MSC DDB incorrectly applied *param, g* to the “stiffness” part of the CAABSF matrix. Unfortunately, our correction results in another error when there are frequency dependent elements (typically CBUSH or CELAS) and *param, g*. This has now been corrected.
7. Please note that every new release of AMLS DDBs is stamped with the creation date, which can be seen in the f06 files. So for



this version, for example, one should see the following in the f06 file:

```
*****
*****
**
**                                **
**          COPYRIGHT 2007          **
**   THIS DMAP PROGRAM HAS BEEN DEVELOPED BY CDH AG   **
**          ALL RIGHTS RESERVED.          **
**          CREATION DATE: 2015-06-10          **
**
*****
*****
```