

Advanced Restart of Nonlinear Analysis

Restarting a Nonlinear Analysis

- **A nonlinear analysis can be restarted or continued from the last point at which the previous analysis was interrupted**
- **When running an analysis, you can write the model information and analysis state information which can be used for restart**



Scenarios

- I. **Restart from interruption** – continue an interrupted nonlinear analysis due to a power outage and so on → v2017

- II. **Restart for subcase appending** – append steps to the load history after a successful nonlinear analysis → v2017.1

- III. **Restart for subcase truncation and appending** – continue an nonlinear analysis from an intermediate point and change the remaining load history → v2017.1

- IV. **Restart for reusing nonlinear solution in linear perturbation** – append linear buckling/preloading steps after a successful nonlinear analysis → v2017.1

Restart for nonlinear

- **Support adding bulk data (listed below) in restart run for use case II, III and IV**
 - SPCADD, SPC, SPC1
 - LOADADD, FORCE
 - DLOAD, TLOAD1, TLOAD2, RLOAD1, RLOAD2, DAREA
 - NLPARM, NLADAPT, NLMON, NLOUT, TSTEPNL, TSTEP, SOLVTYP
 - CNTSTB, MODCHG
 - EIGRL, EIGRA, EIGRC
 - FREQ, FREQ2
 - TABLED1, TABLED2, TABLED3, TABLED4

RESTARTW

- **RESTARTW can be used in I/O section to write out files for a subsequent nonlinear restart analysis**

Format

RESTARTW = *n*, *option*

- **n identifies the frequency of writing nonlinear restart analysis information files**
 - Writes restart analysis information files after every converged load increment(s) including the last converged load increment for a nonlinear subcase
 - OptiStruct writes out one restart model information file (*.rmd) and one or more restart analysis information files (*.rnl) to be used in a subsequent restart run.
 - The .rnl and .rmd files are named in format <filename>_sub<i>_inc<j>.rnl and <filename>.rmd respectively
 - <filename> is the filename of the input deck
 - <i> is the corresponding subcase ID
 - <j> is the corresponding increment number in the subcase
- **Option = COVER(default), COVE2 or NOCOV**
 - COVER: Whenever a new restart analysis information file (*.rnl) is written, the previous restart analysis information file is removed, unless it was written at the end of a subcase
 - COVE2: Whenever a new restart analysis information file (*.rnl) is written, the previous restart analysis information file is removed, unless it was either of the last two frames for a nonlinear subcase
 - NOCOV: Previous restart analysis information files are not removed


Solver deck


RESTARTW


RESTARTW = 1 Keeps only the latest *.rnl files


```
SUBCASE      1
  LABEL rack_pinion
ANALYSIS NLSTAT
  SPC =      1
  NLPARM =   2
NLOUT =      3
CNTSTB =    20
```


Files at the end of analysis
Available in the scratch directory


 rack_pinion_write_frames.html


 rack_pinion_write_menu.html


 rack_pinion_write_sub1_inc0046.rnl


 rack_pinion_write.fem


 rack_pinion_write.h3d


 rack_pinion_write.html

 rack_pinion_write.mvw

 rack_pinion_write.out

 rack_pinion_write.res

 rack_pinion_write.rmd

 rack_pinion_write.stat

Only one *.rnl files

Solver deck

RESTARTW

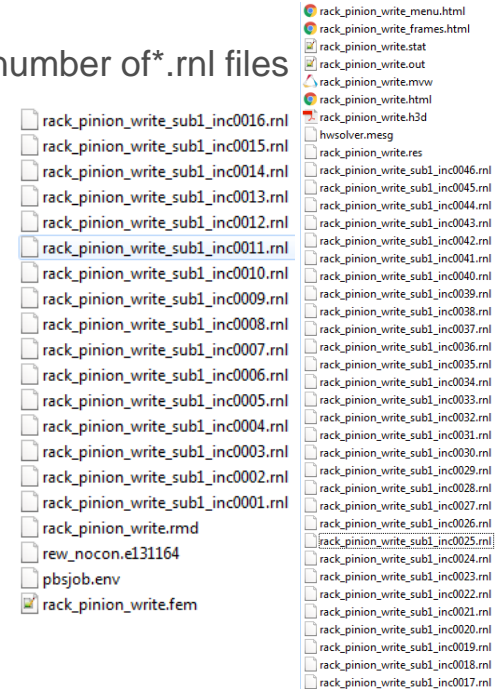
```
RESTARTW = 1, NOCOV
```

Doesn't overwrite previous*.rnl files

```
SUBCASE      1
  LABEL rack_pinion
ANALYSIS NLSTAT
  SPC =      1
  NLPARM =   2
NLOUT =      3
CNTSTB =    20
```

Files at the end of analysis
Available in the scratch directory

A number of*.rnl files



- rack_pinion_write_menu.html
- rack_pinion_write_frames.html
- rack_pinion_write.stat
- rack_pinion_write.out
- rack_pinion_write.mww
- rack_pinion_write.html
- rack_pinion_write.h3d
- hwsolver.mesg
- rack_pinion_write.res
- rack_pinion_write_sub1_inc0046.rnl
- rack_pinion_write_sub1_inc0045.rnl
- rack_pinion_write_sub1_inc0014.rnl
- rack_pinion_write_sub1_inc0013.rnl
- rack_pinion_write_sub1_inc0012.rnl
- rack_pinion_write_sub1_inc0011.rnl
- rack_pinion_write_sub1_inc0010.rnl
- rack_pinion_write_sub1_inc0009.rnl
- rack_pinion_write_sub1_inc0008.rnl
- rack_pinion_write_sub1_inc0007.rnl
- rack_pinion_write_sub1_inc0006.rnl
- rack_pinion_write_sub1_inc0005.rnl
- rack_pinion_write_sub1_inc0004.rnl
- rack_pinion_write_sub1_inc0003.rnl
- rack_pinion_write_sub1_inc0002.rnl
- rack_pinion_write_sub1_inc0001.rnl
- rack_pinion_write.rmd
- rew_nocon.e131164
- pbsjob.env
- rack_pinion_write.fem
- rack_pinion_write_sub1_inc0036.rnl
- rack_pinion_write_sub1_inc0035.rnl
- rack_pinion_write_sub1_inc0034.rnl
- rack_pinion_write_sub1_inc0033.rnl
- rack_pinion_write_sub1_inc0032.rnl
- rack_pinion_write_sub1_inc0031.rnl
- rack_pinion_write_sub1_inc0030.rnl
- rack_pinion_write_sub1_inc0029.rnl
- rack_pinion_write_sub1_inc0028.rnl
- rack_pinion_write_sub1_inc0027.rnl
- rack_pinion_write_sub1_inc0026.rnl
- rack_pinion_write_sub1_inc0025.rnl
- rack_pinion_write_sub1_inc0024.rnl
- rack_pinion_write_sub1_inc0023.rnl
- rack_pinion_write_sub1_inc0022.rnl
- rack_pinion_write_sub1_inc0021.rnl
- rack_pinion_write_sub1_inc0020.rnl
- rack_pinion_write_sub1_inc0019.rnl
- rack_pinion_write_sub1_inc0018.rnl
- rack_pinion_write_sub1_inc0017.rnl

RESTARTR

- RESTARTR can be used in I/O section to define reading requests for nonlinear restart analysis

Format

RESTARTR = <option> file_prefix

- Can have both RESTARTW and RESTARTR in the same file

Argument	Options	Description
option	TERMI, blank Default = blank	TERMI: Truncate the nonlinear subcase at the restarting point. blank: No truncation.
file_prefix	Prefix of .rnl file No default	Identifies the .rnl and .rmd files to be read. The .rnl and .rmd files are named in format <filename>_sub<i>_inc<j>.rnl and <filename>.rmd respectively, where <filename> is the filename of the input deck (prior to .fem), <i> (0<i><100000000) is the corresponding subcase ID and <j> (0<j><10000) is the corresponding increment number in the subcase.

Solver deck

RESTARTR

```
RESTARTR = rack_pinion_write_sub1_inc0022
```

```
SUBCASE      1
  LABEL rack_pinion
ANALYSIS NLSTAT
  SPC =      1
  NLPARM =   2
NLOUT =      3
CNTSTB =    20
```

```
SUBCASE      2
  LABEL rack_pinion2
ANALYSIS NLSTAT
  SPC =      2
  NLPARM =   2
NLOUT =      3
CNTSTB =    20
SOLVTYP =   25
```

Subcase Appending

Part of *.out file

```
Restarting nonlinear solution at subcase 1, increment 22
```

```
Starting load increment 23 Current increment 6.0887E-02
```

```
Subcase      1 Load step: 5.7572E-01
-----
Iter Avg. U      Nonlinear Error Measures      Gap and Contact Element Status      Maximum
            EUI      EPI      EWI      Open Closed Stick Slip Frozen  Pltstrn
-----
  1  1.15E-01  2.02E-01  8.69E-01  1.58E-01  374  198    0    0    0  0.00E+00
  2  1.15E-01  2.63E-02  9.79E-01  5.63E-02  449  123    0    0    0  0.00E+00
```

Need to include following files along side *.fem file:

- rack_pinion_write_sub1_inc0022.rnl
- rack_pinion_write.rmd

Also the rmd and rnl files need to be written from the same OS version