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MEMO

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Release Notes **USFOS Version 7-7**				
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FILE CODE	CLASSIFICATION
	Open
ELECTRONIC FILE CODE	

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Release notes
USFOS 7-7, April 2000

Contents:

1. Introduction

The current version of USFOS (version 7-7, 2000-04-01) is the intermediate release of the 99-00 user group development period.

The current release with date 2000-04-01 contains following:

- CD-ROM
- Updates of User's Manual
- Release Notes (this MEMO)

2. Contents of CD-ROM

2.1. Overview

The CD contains documentation, examples and new versions of the program codes, and the organisation is described in Figure 2.1-1. Both UNIX and NT solutions are collected in the same CD.

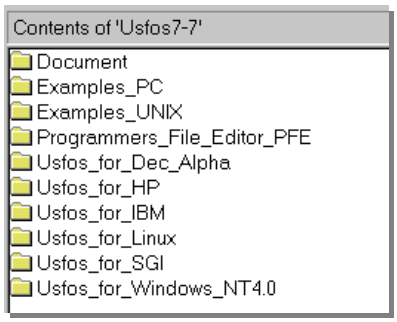


Figure 2.1-1 Contents of CD-ROM

2.2. New versions of the program codes

Under each file folder (f ex "USFOS_for_Windows_NT4.0"), two folders, (bin and etc) are located. The "*bin*" folder contains the program code, while the "*etc*" folder contains set up files.

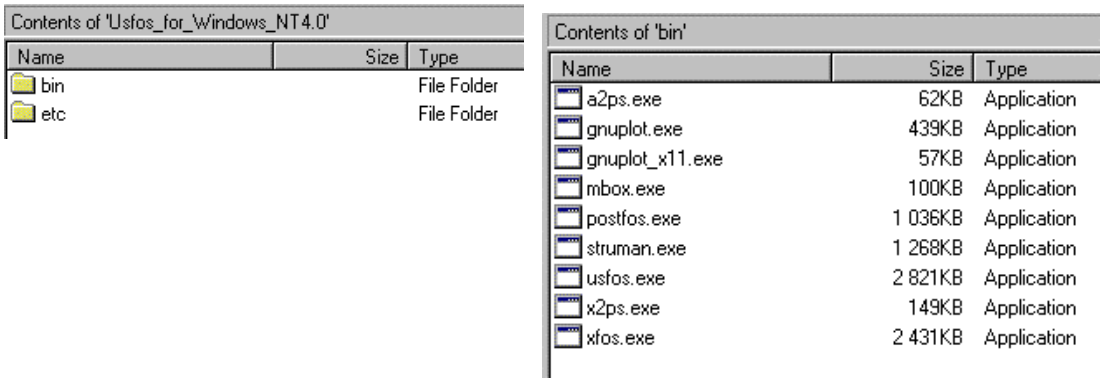


Figure 2.2-1 Program Code located in "bin" folder

Figure 2.2-2 Files in "etc" folder. NT (to the left) and UNIX (to the right)

Installation on UNIX:

- Create a root directory for USFOS, (the new "*USFOS_HOME* " directory)
- Copy the actual "bin" and "etc" directories to *USFOS_HOME*
- Copy the "Examples_UNIX" and "Document" directories to *USFOS_HOME*.
- Define the USFOS_HOME variable in the USFOS.cshrc/USFOS.kshrc files

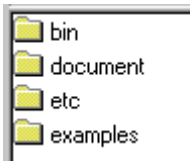


Figure 2.2-3 Contents of "$USFOS_HOME" folder after installation

Installation on Windows NT 4.0

- Copy the new ".exe" files located in the "bin" folder to the existing "USFOS_HOME/bin" folder
- Copy the new "postfos.inca" file located in the "etc" folder to the existing "USFOS_HOME/etc" folder
- Copy the "Examples_PC" and "Document" folders to the existing USFOS_HOME.

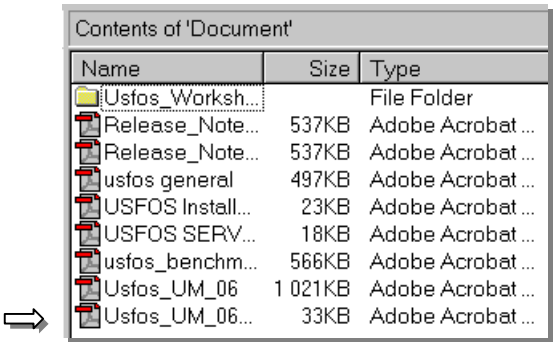
NOTE ! : *If USFOS has never been installed on NT before, please contact SINTEF.*

For all systems:

- Copy the file: "USFOS.key" (delivered on a separate diskette) to the actual "USFOS_HOME/etc" directory.

2.3. Manual

The User's manual is updated, and (paper) copies of the actual pages are delivered. In addition, the most important part of the manual, the "Input Description" (*USFOS_UM_06*) is available for "on-line" reading using f ex. Adobe Acrobat Reader or any other "PDF readers".



A ***free*** "PDF-reader" is available on www.adobe.com .

2.4. Examples

Approx. 50 examples are given under the "Examples" directories. The contents of the UNIX and PC examples are identical, (the only reason for having two folders is due to computer compatibility, UNIX and PC represent the files differently).

The input files are located in separate folders, one example per folder, see Figure 2.4-1. In each folder, following files are found:
Head.fem : USFOS control parameters

Stru.fem : Structure and load description in either SESAM or UFO file format. In some cases *both* SESAM and UFO formats are given for the same example, and then the “stru-file” has a postfix, u for UFO and s for SESAM. Any of the two variants (stru_u.fem or stru_s.fem) should produce the same results. The USFOS control parameters are unaffected by the file format used to describe the structure and loads. (See also Chapter 3).

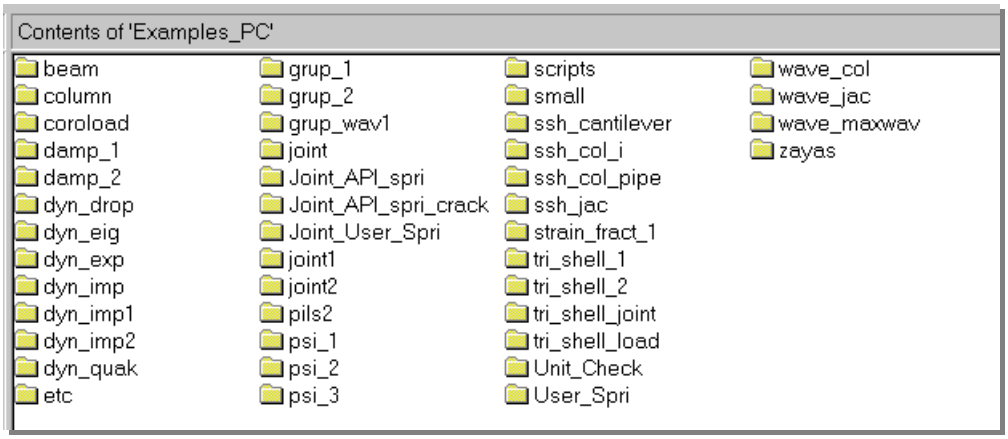


Figure 2.4-1 Example folders available for UNIX and NT(PC)

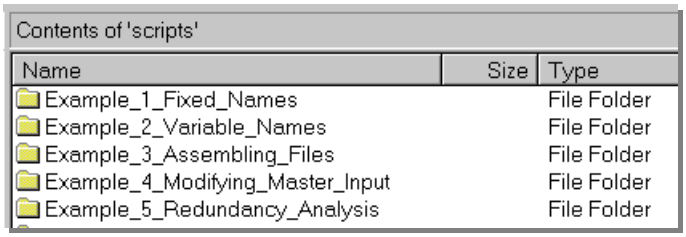


Figure 2.4-2 Contents of “Script folder available for UNIX and NT(PC)

3. Efficient use of USFOS

3.1. General

Seldom, only one USFOS analysis is performed for a given problem. The more typical use is repeated runs due to several load cases, parametric (sensibility) study, model change, etc.

In cases where many USFOS analyses should be performed, well organising of both input and output files is important. There should be no doubt about “what was the parameters used for

this particular result plot" and so on. It is highly recommended to ***not*** use one input file set, which is modified over and over again until all cases are run, because:

- Possible confusion about input parameters used
- Difficult to repeat the analyses after a time
- Requires manual editing before each new run, impossible to automate

It's better to plan and organise the USFOS analysis in a way that makes it possible to, ultimately, perform hundreds of analyses using only one, (magic) command. One solution (among several) is using UNIX scripts, and the following sections will describe this solution.

USFOS (even on Windows NT) runs in a UNIX environment, and all procedures described in the sections below are running on "all" computer platforms. However, some differences may occur, (f. ex: *C:/TEMP* on PC and */tmp* on standard UNIX).

The next sections will deal with use of UNIX commands typed in from the keyboard in the "old fashion way". It's therefor worth spending some minutes adjusting the UNIX command prompt window.

3.2. Adjusting the UNIX korn shell window

Before you start using the UNIX korn shell, it's recommended to modify slightly the layout. Figure 3.2-1 shows the default window with white text an black background and with size 24 lines / 80 columns). To modify the window, point on the (blue) top frame of the window, and press the right hand button. The menu Figure 3.2-2 appears.

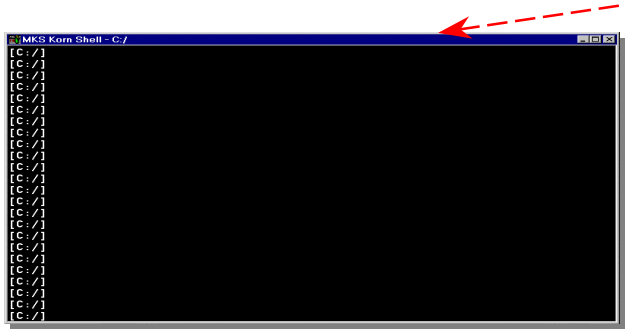


Figure 3.2-1 The default NutCracker Window layout

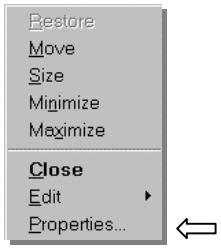


Figure 3.2-2 Menu

Select *Properties* and the "*select colors"* menu shown in Figure 3.2-3 appears.

Select *screen text* and *screen background* among the indicated colours. The light grey background together with black text is a good combination.

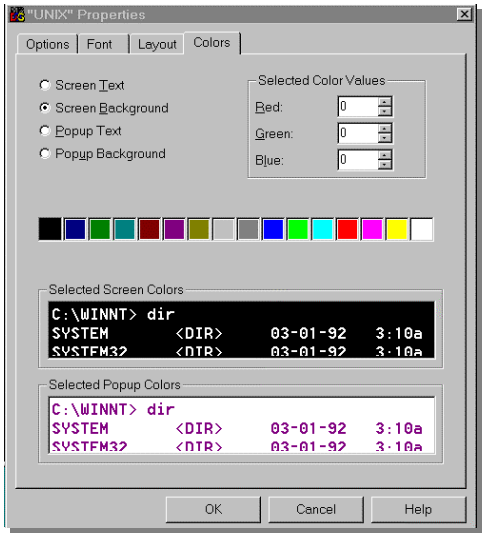


Figure 3.2-3 Defining screen- and text colour

The default window has no screen buffer (has no scroll bar), but the buffer sizes in vertical (number of lines) and horizontal (number of columns) are possible to specify under the *layout* menu, see Figure 3.2-4. Type in (or us the arrow) the actual sizes, which here is set to 132/2048. The window size when it pops up is set to 80/40.

When the OK button is pressed, the menu shown in Figure 3.2-5 appears. Select "*Modify Shortcut*" to save the settings permanently.

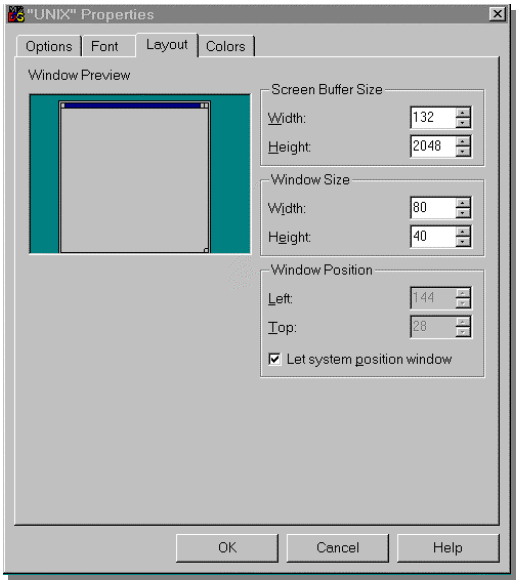


Figure 3.2-4 Defining window layout

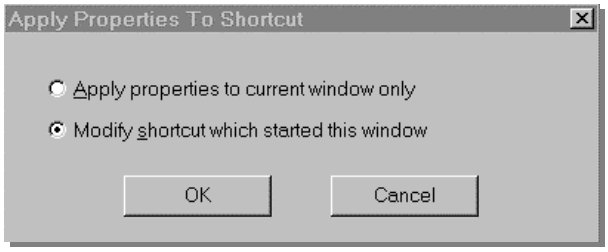


Figure 3.2-5 Selecting permanent modification of the short cut

The UNIX window will from now on look like the one in Figure 3.2-6 with two scroll bars (and it's resizable) and a comfortable colour.

Figure 3.2-6 The modified NutC window with scroll bar.

3.3. Some UNIX commands

The procedures described in the examples below require that the users knows some UNIX commands, and in the following a brief summary of the commands used in the scripts is given:

Command / Argument	Description	Use
cp	*Copy one file into another*	*cp "from file" "to file"*
mv	*Rename a file or directory*	*mv "from name" "to name"*
cat	*dump the content of a file to screen*	*cat "file"*
cat >	*dump the content of file_1 into file_2*	*cat "file1" > "file2"*
cat >>	*dump content of file1 behind existing content of file 2 (append)*	*cat "file1" >> "file2"*
mkdir	*create a directory (folder)*	*mkdir "directory name"*
cd	*change directory*	*cd "directory name"*
..	*directory path. (one level up)*	*cd ..*
.. /..	*directory path. (two levels up)*	*cd .. /..*
.. /dir_name	*directory path (one level up and one down)*	*cd .. /case2* *cp "file1" ".. /case2/file2"*
$NAME	*Environmental variable with name NAME*	*cp $MASTER/file1 file2*
echo $NAME	*"Show me the content of the environmental variable whit name NAME"*	*Will be used in the examples below*
sed	*"Stream Editor"*	*Will be used in the examples below*
rm	*Delete file(s)*	*rm file1* *rm file1 file2 file3 ….*
rmdir	*Delete directory*	*rmdir directory_name*
ls	*List files*	*ls*
*ls *.fem*	*List all files with extension .fem*	

Table 3.3-1 UNIX commands overview

3.4. Example 1, Fixed USFOS input file names

The simplest example on a UNIX script (which saves you for tediously typing) is a file with name ***go1*** containing following:

```
$USFOS_HOME/bin/usfos  15   << ENDIN
head
stru
load
res
ENDIN
```

Table 3.4-1 Content of script file: "go1" with 3 fixed USFOS input files

Explanation:

The variable USFOS_HOME is set during installation of USFOS on both UNIX and NT computers. It contains the file path of the root of the actual USFOS version. By prefixing the variable name with $, the contents of the variable name becomes available for use in connection with any UNIX command.

"$USFOS_HOME/bin/usfos" is the address to the USFOS code, and by adding 15 after the file name, a workspace of 15 mill is required.

The "<< ENDIN" defines that the usual screen input/output is given between in the lines between << ENDIN
and
ENDIN
The name "ENDIN" is an arbitrarily chosen name of the label.

In a usual USFOS run, it's first asked for the control file name prefix, which here is set to "head". Further it's asked for the structural and load files, which here are "stru" and "load" respectively.
Finally, USFOS asks for the result file prefix, which is set to "res".

By typing ***go1*** USFOS will start, use the input files head.fem, stru.fem and load.fem, and store the results in files with prefix: *res*. All input files must be located on the same directory as the script file ***go1*** , and results are stored in the same directory.

As USFOS accepts input from one, two or 3 files, it's possible to leave up to two file names blank as shown in Table 3.4-2, where the 'load' file is left out.

```
$USFOS_HOME/bin/usfos  15   << ENDIN
head
stru

res
ENDIN
```

Table 3.4-2 Content of script file: "go2" with only "head" and "stru" input files

It is possible to access files located on other directories than the directory where the script ***go*** is located /and started from). Table 3.4-3 describes the case where some files are located on different directories:

```
$USFOS_HOME/bin/usfos  15   << ENDIN
head_intact_nw_100yr
../model/intact_stru
../loads/nw_100yr
D:/temp/res_intact_nw_100yr
ENDIN
```

Table 3.4-3 Content of script file: "go3" with input files located on different directories

In this case, the control file (head_intact_nw_100yr.fem) is located on same directory as the script file (and where the script is started from). The structural file (stru.fem) is located in the directory *model* (which is located on same level, besides, the current directory), and the file is named *intact_stru.fem*.

The load file is located on an other directory (also on same level as the other two) with name *loads*, in a file with name *nw_100yr.fem*

The results are saved on the D: disc, on a directory named *temp*, and file *res_nw_100.raf*.

The third variant of the "fixed name script": ***go3*** indicates a first try to organise an analysis series involving several versions of the structural file, (f ex *intact* and *damaged*), and several loads (f ex *nw_100yr, nw_1000yr, sw_100yr, sw_1000yr*, etc).

This leads to the next example, which will give an example on how a slight modified ***go3*** could be used for many different analyses.

3.5. Example 2, Varying USFOS input file names

The "fixed name script", *go3* described above is slight modified. Instead of defining the file names 100%, some of the file name is substituted by the keywords ***$1*** and ***$2***. It's possible to give input parameters to UNIX scrips, and ***$1*** is parameter no. 1, ***$2*** is parameter no. 2 etc…

```
$USFOS_HOME/bin/usfos  15   << ENDIN
head_$1_$2
../model/$1_stru
../loads/$2
D:/temp/res_$1_$2
ENDIN
```

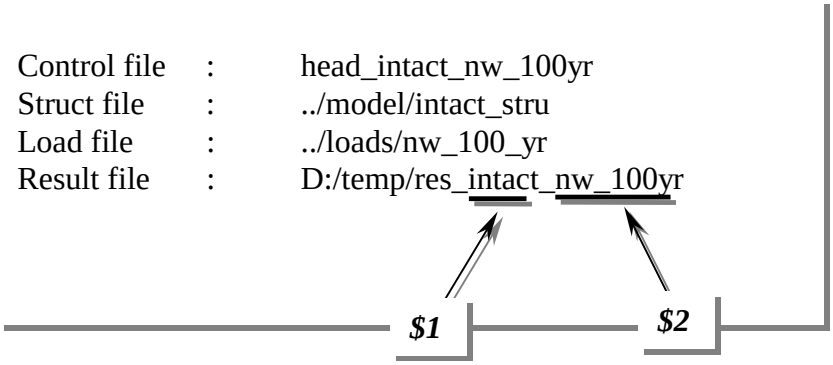
Table 3.5-1 Content of script file: "go" with varying input file names

By typing:

go intact nw_100yr

the same analysis as described under example 1, go3 will be performed.

The ***$1*** variable will be expanded to ***intact*** inside the script, and ***$2*** will be expanded to ***nw_100yr***, which gives the actual file names:



A script file may not only refer to UNIX commands, it's possible to refer to other script files as well. This leads to next level in script programming: defining a top level script, which refers to user defined script(s).

If f ex. one analysis series should consist of a number of different structural conditions, different load directions and – conditions, the following script named ***run_all*** would run through all 16 cases without need for any human interference.

```
# ------------------------------------------------------
# --  Script for running: - 2 structural conditions, --
# --                      - 4 load directions  and   --
# --                      - 2 load conditions        --
# --  Totally 2x4x2=16 cases.                        --
# ------------------------------------------------------
#
#     Structure     Load
go     intact      nw_100
go     intact      sw_100
go     intact      se_100
go     intact      ne_100
#
go     intact      nw_10000
go     intact      sw_10000
go     intact      se_10000
go     intact      ne_10000
#
go     damaged     nw_100
go     damaged     sw_100
go     damaged     se_100
go     damaged     ne_100
#
go     damaged     nw_10000
go     damaged     sw_10000
go     damaged     se_10000
go     damaged     ne_10000
# ----------------  End of Script File  ------------------
```

Table 3.5-2 Content of level 2 script file: "run_all", which refers to "go".

3.6. Example 3, Assembling input files before USFOS analysis

In the previous examples, all input files were complete before the script was executed. In may cases, only a small fraction of the entire input is different from one case to another. Instead of making lots of copies of near 100% equal files, the key in this example is to show how the input files could be composed by common information + some special information.

Common information:

- Control file, : head.fem
- Main structure located in : str/Main_Strucutre
- Main load located in : loa/Main_Load

Special information:

- Support Structure : str/Spring_Support_1 and _2
- Special Load : loa/Node***i***_Load

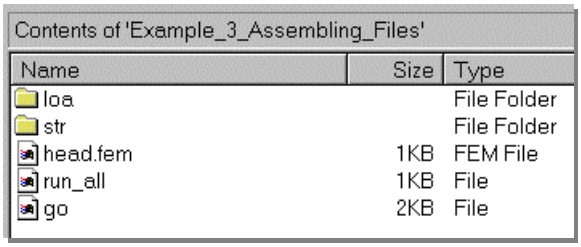


Figure 3.6-1 Content of file folder *before* running script "run_all".

The idea is as follows:

- Use the control file *head.fem* in all cases.
- Compose a structural file consisting of the common *Main_Structure* and the special support, and assemble the complete structural model in the file *stru.fem*.
- Compose a load file, which should consist of the common load file Main_Load and the special nodal load, and collect all load info in the file *load.fem.*
- Create a new, unique directory (below current directory) for each case with informative name reflecting the actual case.
- Run USFOS an save stru- and load files + result files on the actual directory.
- Create script ***go*** for running on case, and ***run_all*** for running all 6 combinations

In Table 3.6-1 the script with name ***go*** is described in detail as it appears in the example folder. Lines staring with the sign # is comment lines, and may appear anywhere in the script file except between << *ENDIN* and *ENDIN*. (It is recommended to use *comments*, both in scripts and in the USFOS input files).

Firstly, the ***cp*** command is used to copy the main structure to the file *stru.fem*. Next, the selected support structure is appended to the stru.fem using the ***cat*** >> command. Similar is done for the load file assembly.

A unique directory for each case is created using the ***mkdir*** command, and the directory name (with prefix *Case_*) contains information about both support and load. USFOS is started with 15 mill and results are saved in the actual Case directory using the result file prefix ***res*** for all cases (the directory contains information about the different cases). Finally, the actual stru.fem and load.fem are moved into the actual Case directory using the ***mv*** command. (Note that if only directory name is defined in connection with the ***mv*** command, the file name will be unchanged in the new directory, just moved.)

```
# =======================================================
# -- Script for assembling USFOS input and run USFOS   --
# -- Usage:  go   par1   par2                          --
# -- par1  : Support Structure                          --
# -- par2  : Load definition                           --
#-------------------------------------------------------
#                                              - Copy Main Structure into
#                                                file stru.fem and add
#                                                selected support:
cp   str/Main_Structure           stru.fem
cat  str/$1                  >>  stru.fem
#                                              - Copy Main Load into
#                                                file load.fem and add
#                                                selected load:
cp   loa/Main_Load                load.fem
cat  loa/$2                  >>  load.fem
#                                              - Run USFOS and save results
#                                                in unique directories:
#
#                                                .. Create Directory
mkdir Case_$1_$2
$USFOS_HOME/bin/usfos  15   << ENDIN
head
stru
load
Case_$1_$2/res
ENDIN
#                                                .. Move stru.fem and load.fem
#                                                   into actual Case_Dir for
#                                                   backup purpose.
mv  stru.fem   Case_$1_$2
mv  load.fem   Case_$1_$2
#
# ---------------- EOF ------------------------------
```

Table 3.6-1 Content of script file: "go" which assembles input files & runs USFOS

```
#          Support                Loa
go      Spring_Support_1      Node1_Load
go      Spring_Support_1      Node3_Load
go      Spring_Support_1      Node5_Load
#
go      Spring_Support_2      Node1_Load
go      Spring_Support_2      Node3_Load
go      Spring_Support_2      Node5_Load
#
```

Table 3.6-2 Content of script file: "run_all", which executes the script “go”.

After the script ***run_all*** is completed, 6 new file folders (directories) are created, see Figure 3.6-2. All directories contain the actual, assembled input (stru and load) + the result files (res.*).

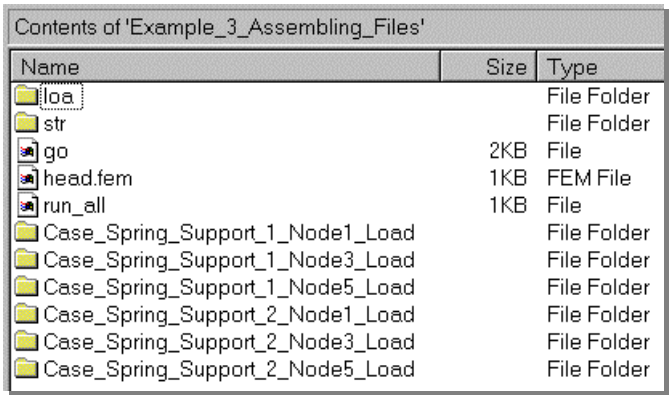


Figure 3.6-2 Content of file folder *after* running script "run_all".

3.7. Example 4, Using the SED editor to modify master input files

In the previous example, the input to USFOS was composed by some common files + special files, and in all cases the content of the files were pre defined.

In the current example, another, and even more flexible solution is chosen. Instead of assembling 'pieces' of input, the ***content*** of the input file(s) are modified prior to the analysis. As the modification should be performed in a batch run, *a batch editor is necessary*. The UNIX shell on both UNIX workstations and the "NutCracker" UNIX shell on Win-NT offers the SED editor, the "Stream EDitor".

The operation needed from the stream editor is the "REPLACE" or "SUBSTITUTE" command, where one character string should be replaced by another.

The (cryptic) UNIX command is wrapped into a file, which here is named ***substitute***, Table 3.7-1, and which is used as follows:

Substitute "string_1" "string_2" FileName

In all connections where *string_1* occur on the specified file, it's replaced by *string_2*. The SED editor is case sensitive (differs between upper and lower case characters). Quotes must be used if blank character(s) occur in the strings.

```
sed "1,$ s/$1/$2/g"  $3 > subst_string.temp
mv subst_string.temp  $3
```

Table 3.7-1 Script "*substitute*", which utilises the *SED* editor for substituting strings.

With the powerful ***substitute*** script available, following operations should be done:

- Create only one master USFOS control file (which should be used for all cases)
- Use one structural file
- Run USFOS wave analysis for 8 different wave/current conditions.

As indicated in Figure 3.7-1, some files are present before the analyses are performed, and some are created during the analysis (executing the scripts defined in this section).

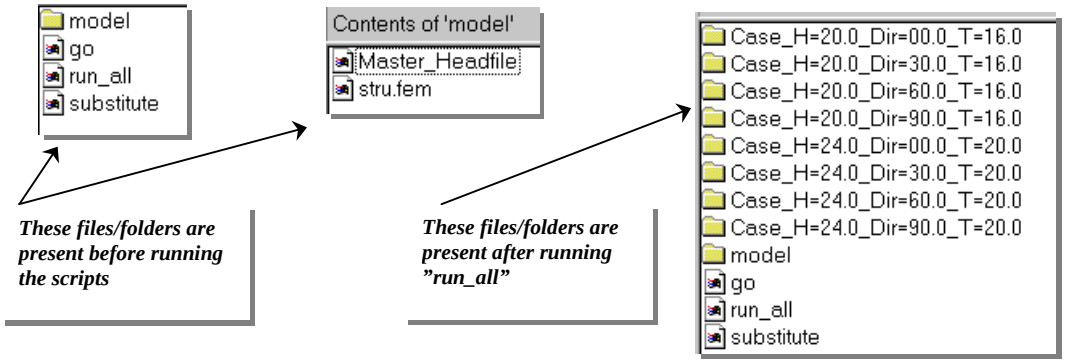


Figure 3.7-1 Files / Folders before and after running the scripts

Master Headfile, Table 3.7-2.

The file is an ordinary control file for USFOS, but some parameters are not yet set. Instead, the parameters are represented by arbitrarily chosen key words. In the actual study, the wave height, direction and period should be varied, and the keyword for the wave height is WAVEH, the keyword for direction is DIRECT, and the keyword for wave period is PERIOD.

Script file "go",Table 3.7-3 :

The first operation in the script is creating a directory using the ***mkdir*** command, and all 3 parameters (wave- height, direction and period) are included in the directory name.

Next, the nearly complete USFOS control file (named *Master_Headfile* and located in directory *model*) is copied into the file ***head.fem*** on current directory. The script for substituting (named *substitute*) is used three times for replacing the keywords with the actual parameter values.

Then USFOS is run, and the same structural file (*stru.fem*) is used for all cases. Results are saved on the actual Case directory, and result prefix is ***res***. When USFOS is finished, the (manipulated) *head.fem* is moved into the actual Case directory, (see Table 3.7-5 for example on modified head file).

```
HEAD       USFOS Extreme Wave. Height: WAVEH , Dir: DIRECT , T : PERIOD
         Progressive Collapse Analysis  / JACKET model
                          SINTEF  2000
'
'
'                                                - Define Wave:
'
'           Ildcs  <type>   H    Period   Direction Phase  Surf_Lev Depth
 WAVEDATA      2   Stoke  WAVEH  PERIOD    DIRECT    0.0     0.0     100
'
'           Ildcs  Speed Direction Surf_Lev Depth    [Profile]
 CURRENT       2     2     DIRECT       0.0    100      0.0  1.0
                                                      -20.0  1.0
                                                     -100.0  0.0
```

Table 3.7-2 "Master_Headfile" with keywords: WAVEH, DIRECT and PERIOD

```
# ======================================================
# -- Script for assembling USFOS input and run USFOS   --
# -- Usage:  go   Wave_Height   Direction   Period     --
#------------------------------------------------------
#                                                .. Create Directory
mkdir Case_H=$1_Dir=$2_T=$3
#
#                                               - Copy Master control file
#                                                 into the current head
#                                                 file:
cp   model/Master_Headfile        head.fem
#                                                .. Substitute the string
#                                                   "WAVEH" with the first
#                                                    script parameter ($1)
#
substitute       WAVEH      $1    head.fem
#                                                .. Similar for par. 2 & 3:
substitute       DIRECT     $2    head.fem
substitute       PERIOD     $3    head.fem
#                                               - Run USFOS and save results
#                                                 in unique directories:
#
$USFOS_HOME/bin/usfos  15   << ENDIN
head
model/stru

Case_H=$1_Dir=$2_T=$3/res
ENDIN
#                                                .. Move head.fem
#                                                   into actual Case_Dir for
#                                                   backup purpose.
mv  head.fem   Case_H=$1_Dir=$2_T=$3
#
```

Table 3.7-3 Script file "go"

Script file "run_all" Table 3.7-4

The script file ***run_all*** starts ***go*** 8 times with different input parameters.

```
# ======================================================
# -- Script for running 8 diffenent USFOS cases        --
#------------------------------------------------------
#
#
#         Wave Height   Wave/Curr Direction   Period
go            20.0             00.0             16.0
go            20.0             30.0             16.0
go            20.0             60.0             16.0
go            20.0             90.0             16.0
#
go            24.0             00.0             20.0
go            24.0             30.0             20.0
go            24.0             60.0             20.0
go            24.0             90.0             20.0
#
# --------------  End of Script run_all ----------------
```

Table 3.7-4 Script file "run_all"

```
HEAD       USFOS Extreme Wave. Height: 20.0 , Dir: 00.0 , T : 16.0
         Progressive Collapse Analysis  / JACKET model
                          SINTEF  2000
'
'
'                                                - Define Wave:
'
'           Ildcs  <type>   H    Period   Direction Phase  Surf_Lev Depth
 WAVEDATA      2   Stoke  20.0  16.0    00.0    0.0     0.0     100
'
'           Ildcs  Speed Direction Surf_Lev Depth    [Profile]
 CURRENT       2     2     00.0       0.0    100      0.0  1.0
                                                    -20.0  1.0
                                                   -100.0  0.0
                                                   -110.0  0.0
```

Table 3.7-5 USFOS control file modified by the SED editor.

After all 8 cases are run, 8 new directories are created (see Figure 3.7-1) containing the modified *head.fem* and the analysis results. Figure 3.7-2 shows results from one of the 8 analyses, and NOTE that the member imperfections (command CINIDEF) are applied automatically according to the actual wave load direction (which here is 30°).

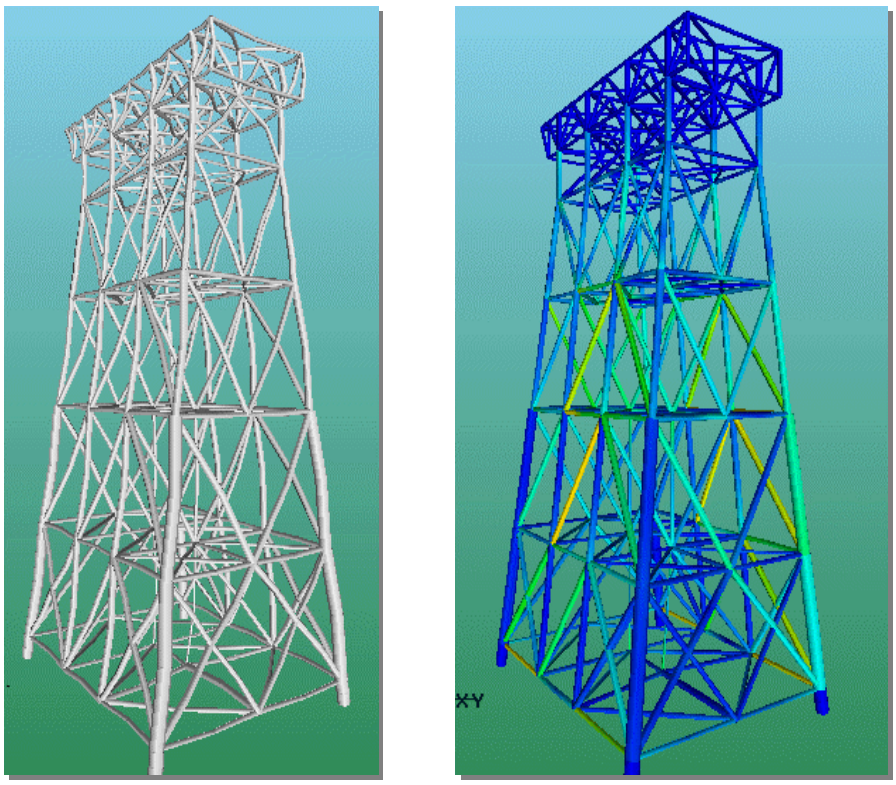


Figure 3.7-2 Case with H=20m, Dir=30deg and T=16s

3.8. Example 5, Procedure for element removal (redundancy analysis)

The final example solves following problem:

- Remove the structural members, one by one
- Use the same structural file and control file
- Save the results from the analyses in separate file folders

Figure 3.8-1 shows the content of the example folder before and after running the actual scripts. The scripts are organised in the *etc* folder, while the structural model is stored in the *model* folder. The content of the script files are described in Table 3.8-1, Table 3.8-2 and Table 3.8-4.

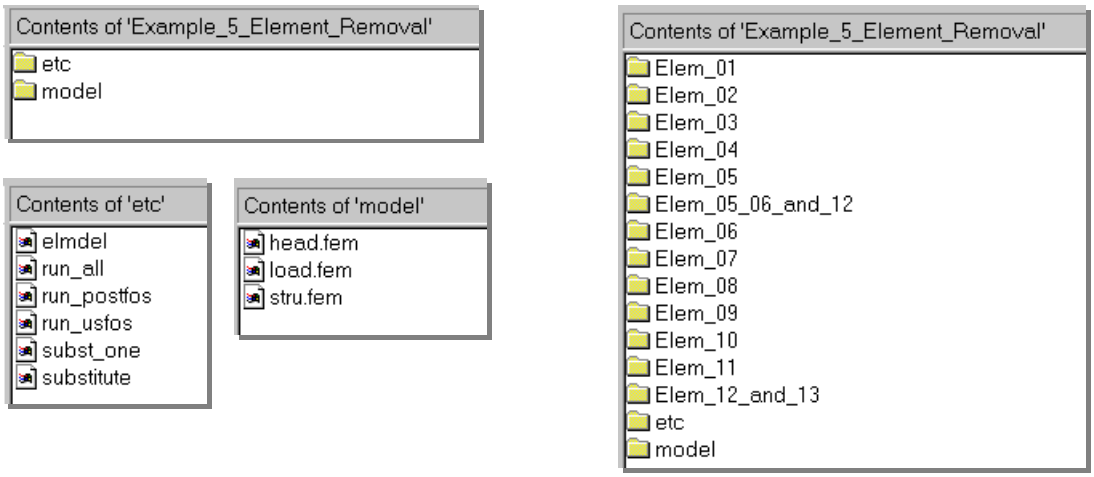


Figure 3.8-1 Files / Folders before and after running the script

```
#                                      - Define varible SCRATCH
#                                        (directory for Raf file storing)
export  SCRATCH=/tmp/scratch
#
#        Local Dir       Element to remove
elmdel   Elem_01            01
elmdel   Elem_02            02
elmdel   Elem_03            03
elmdel   Elem_04            04
elmdel   Elem_05            05
elmdel   Elem_06            06
elmdel   Elem_07            07
elmdel   Elem_08            08
elmdel   Elem_09            09
elmdel   Elem_10            10
elmdel   Elem_11            11
elmdel   Elem_12_and_13     12  13
elmdel   Elem_05_06_and_12   5   6  12
#
# -------------  End of Run_All -------------------
```

Table 3.8-1 Script file “run_all”

The *run_postfos* script runs POSTFOS and creates the default history table, using the *define-history* and *print-history* commands. (Similar scripts could be created for extracting nodal displacements of selected nodes, element forces etc.)

```
$USOS_HOME/bin/usfos  << ENDIN
head
stru
load
$SCRATCH/res
ENDIN
```

```
$USOS_HOME/bin/postfos  << ENDIN

$1

define-hist,,,,,,

print-hist,,,,,,,

q
ENDIN
```

Table 3.8-2 Scrips: "run_usfos" and "run_postfos"

Figure 3.8-2 shows the content of one automatically created file folder (named Elem_01), which contains the global history created by POSTFOS , the log files from the analysis and the different input and output files. Table 3.8-3 shows the content of the file *nonstru_elem.fem*, (which is created by the script), for two cases: To the left the case where element number 1 should become non structural, and to the right the case where elements 5,6 and 12 should be removed.

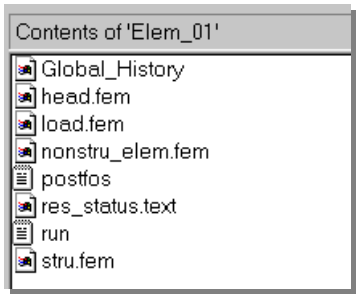


Figure 3.8-2 Files created automatically in folder *Elem_01*

```
'
' ----------------------------
' -- Nonstructural Members   --
' ----------------------------
'
'           Type
 NONSTRU   Element    01
'
' --------- E O F -------------
```

```
'
' ----------------------------
' -- Nonstructural Members   --
' ----------------------------
'
'           Type
 NONSTRU   Element    5
 NONSTRU   Element    6
 NONSTRU   Element    12
'
```

Table 3.8-3 Automatically created files containing the NONSTRU comand.

```
#############################################################################
#    Author : Tore Holmas, SINTEF Group. Norway                             #
#    Date   : 2000-03-18                                                    #
#############################################################################
#
if
   test "$#" -lt "2"
then
   echo '                ************************************************'
   echo '                *                                              *'
   echo '                *   Creates the directory "../Label"  ,        *'
   echo '                *   creates a copy of usfos control file and   *'
   echo '                *   adds necessary NONSTRU commands.           *'
   echo '                *                                              *'
   echo '                *   Assumes structural file on ../model/stru.fem *'
   echo '                *                                              *'
   echo '                *   Results are stored on file "$SCRATCH/res"  *'
   echo '                *                                              *'
   echo '                *   Usage: elmdel <Label> elem1  elem2  elem3 .. *'
   echo '                *                                              *'
   echo '                *                                2re, March 2000  *'
   echo '                ************************************************'
else
   echo "  "
   echo "  Creates directory ../$1       "
   mkdir                    ../$1
   cd                       ../$1
   count="1"
   for i do
      if (test "$count" -gt "1")
      then
         echo "       Processing  Element    :  $i "
         if (test "$count" -eq "2")
         then
#                                              - Heading :
            echo "'                              "       > nonstru_elem.fem
            echo "' ----------------------------- "      >> nonstru_elem.fem
            echo "' -- Nonstructural Members   -- "      >> nonstru_elem.fem
            echo "' ----------------------------- "      >> nonstru_elem.fem
            echo "'                              "      >> nonstru_elem.fem
            echo "'           Type               "      >> nonstru_elem.fem
         fi
#                                              - Add to file :
         echo " NONSTRU   Element    $i "         >> nonstru_elem.fem
         if (test "$count" -eq "$#")
         then
#                                              - Tail:
            echo "'                              "      >> nonstru_elem.fem
            echo "' --------- E O F ------------- "      >> nonstru_elem.fem
         fi
      fi
#                                              - Update counter:
      count=`expr $count + 1`
      done
# ================================================================
      echo "  Grabbing  USFOS master control file from ../model  "
      cp ../model/head.fem        .
      echo "  Adds nonstru commands ...........                  "
      cat nonstru_elem.fem >> head.fem
      echo "  Creates Case identifier : $1 on head.fem           "
      ../etc/substitute  CASEID     $1        head.fem
      echo "  Grabbing  USFOS stru & load file from    ../model  "
      cp ../model/stru.fem        .
      cp ../model/load.fem        .
      echo "  and start USFOS                                    "
      ../etc/run_usfos                   >    run.log
      echo "  and POSTFOS                                        "
      ../etc/run_postfos  $SCRATCH/res  >>    run.log
      echo "                                                     "
      echo "  Saves Global History on current directory .......  "
      echo "                                                     "
      echo "                                                     "
      echo "                                                     "
      echo "                                                     "
      mv $SCRATCH/res.pri             Global_History
      mv $SCRATCH/res_status.text     .
fi
```

Table 3.8-4 Script file “elmdel”

4. New Features

4.1. Group definition

- Groups are introduced in the latest USFOS version (7-7).
- A group is identified by its ID, which is a number (up to 8 digits).
- Elements become “members of” groups, and the same element may participate in several groups.
- The nodal points, to which the elements are attached, becomes “members of” the actual group.

The groups are referred to in connection with assigning properties to elements, which will ease the input (reduce the amount of input lines). In xfos its possible to include/exclude groups in the structural image (Edit/Clip/Group).

Elements are defined “members of” a group using the GROUPDEF command. The element may be identified through:

- Element ID
- All elements referring to given material ID’s
- All elements referring go given cross section geometry ID’s
- All elements ‘members of’ existing groups

The actual way of defining the elements is specified using the parameters “Elem”, “Mat”, “Geo” or “Group” as shown in Table 4.1-1.

```
'            ID   Type      { ID-List }
 GroupDef   888   Elem       10  20 30
 GroupDef  88881  Mat         1
 GroupDef    88   Geo         5
 GroupDef     8   Group       88881 88
'
```

Table 4.1-1 Defining element groups using of the GROUPDEF command

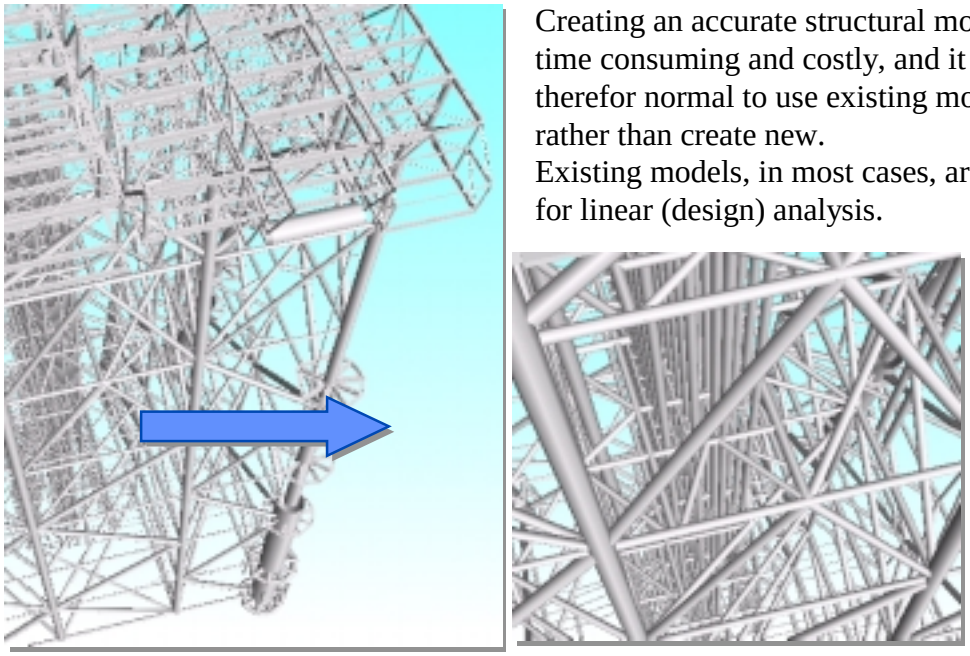
If wanted, extra nodes could be defined “members of” an actual group, and the command “groupnod” is used for this purpose, see Table 4.1-2. This command is used in connection with ‘guiding’ loads from non structural members towards (kept) structural nodes.

```
'          Group ID       Nodes……

 GroupNod     888        70 80 90
```

Table 4.1-2 Assigning (extra) nodes to a group using the GROUPNOD command

4.2. Model repair



Creating an accurate structural model is time consuming and costly, and it is therefor normal to use existing models rather than create new.
Existing models, in most cases, are created for linear (design) analysis.

Figure 4.2-1 Large Challange for Non Linear Analysis

Seldom, existing models are created with non linear analysis in mind, and substantial work has to be done before it's suited for non linear problems. As computers are getting faster, the model size may increase correspondingly. But, modification of models means in practice manual work, and the bigger models, the more man hours have to be spent in order to 'repair' the linear model. A few years ago, a typical jacket structural model consisted of 500-1000 members. Today the same structure is represented by 5000-10000 members.
An increasing part of the model is ***non structural*** members introduced of different reasons in the linear analysis, see Figure 4.2-1 for typical example.

If possible, the original structural model should become "read only", and an "intelligent filter" should transfer the 'linear' model into a model accepted by the non linear tool, see Figure 4.2-2.

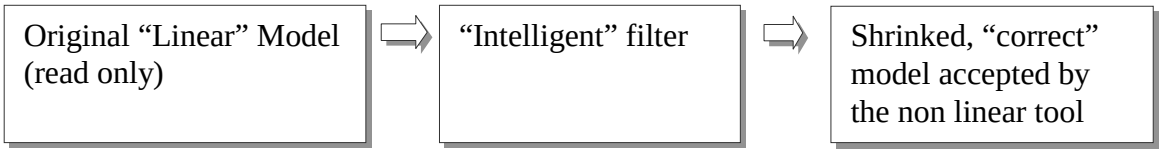


Figure 4.2-2 Preferred "Model Repair" solution

Often, the original (linear) model will not run at all, the analysis fails due to lack of boundary conditions, etc. To be able to inspect the structure in XFOS, the use of the dynamic load procedure is a useful intermediate solution, see Table 4.2-1. In an early modelling stage, the gravity loading is sufficient load to ensure that all elements are connected, boundary conditions correct, etc.

```
Dynamic   0.1    0.025  0.1 0.1
LoadHist    1    1
TimeHist    1   Points  0 0   1 1  1000 1
```

Table 4.2-1 Using dynamic load procedure

Table 4.2-2 shows the group definition used on a 'real' example, and it's here defined 5 groups, which all use geometry ID's to identify the elements. The general cross sections and the small diameter pipes (D<300mm) are grouped, because elements referring to those beams are the typical secondary members, which should be removed from the analysis model.

When the groups are defined, one single NONSTRU command will remove all the "members of" the actual groups from the analysis model (but loads are kept).

```
'-------------------------------------------------------------
' Specify Groups. (Which should become nonstructural)
'-------------------------------------------------------------
'              Type      List......
 GroupDef 1000  Geom
'                                              - GenBeams
'
  10101 10228 10229 10230 10231 10251 10252 10352 15198 15199
  16106 16129 16193 16194 16195 16196 16197 16198 16199 16206
  16229 16293 16294 16295 16296 16297 16298 16299 16306 16329
  16393 16394 16395 16396 16397 16398 16399 16406 16429 16493
  16494 16495 16496 16497 16498 16499 16506 16529 16593 16594
  16595 16596 16597 16598 16599 16606 16629 16693 16694 16695
  16696 16697 16698 16699 17529 17592 17593 17594 17597 17598
  17606 17629 17693 17694 17695 17696 17697 17698 17535 17600
  17634
'
 GroupDef  2000   Geo
'                                              - Pipes 1
'
  19107 19108 16202 16302 10253 16102 16402 17502 17602 16502 16602
  10102 10104 15110 19106 15186 10106 10105 10107 19105 15111 15106 19104 20110
  10113 10360 10111 15185 15112 15107 10109 10112 19103 20095 20096 20094 15114
  15113 20097 15191 20099 20098 16607 10117 16407 16307 16207 16107 16507 10365
  10243 17607 10367 10118 10114 10116 10119 20111 10122 20124 16213 16212 16214
  16109 16110 16209 16114 16210 16112 16113 17509 17510 17511 16614 16610 16612
  16613 17512 17612 17613 17614 17610 17513 17514 17609 16609 16314 16409 16410
  16313 16309 16310 16312 16412 16512 16513 16514 16510 16413 16414 16509 10121
  10120 19102 16617 16616 15189 17517 17516 15115 16516 16416 16417 16316 16317
  16517 15108 16216 10123 10125 10126 16217 17617 17616 16117 16116
  16218 16119 16318 16118 16618 20085 16619 17619 17618 16519 20122 16419 16418
  20112 16518 17620 16120 16420 16320 16520 16620 16220 10127 19101
'
 GroupDef  3000   Geo
'                                              - Pipes 2
'
  10102 10104 10105 10106 10107 10109 10111 10112 10113
  10128 10130 10131 20072 20113 20114 10181 19109
  20075 20076 20077 20073 20074 20080 20082 20080
  20082 10185 10186 10102 10253 16202 16302 16402 16502 16602
  17502 17602 10114 10365 10183
'
 GroupDef 16319   Geo   16319
 GroupDef 16219   Geo   16219
'
'-------------------------------------------------------------------------------
' SPECIFY Groups 1000, 2000 and 3000 NonStructural.
'-------------------------------------------------------------------------------
# NonStru  Group   1000 2000 3000
```

Table 4.2-2 Shrinking model using the GROUPDEF and NONSTRU commands

If the definition of the bounding surface (the gbound command) is left out for general sections, default values are used and a warning is printed, see Table 3.5-2. The default values are shown in the same table.

```
 * Warning. GBOUND input not specified for General Beam:   10101. Default used.
 * Warning. GBOUND input not specified for General Beam:   10228. Default used.
 * Warning. GBOUND input not specified for General Beam:   10229. Default used.
 * Warning. GBOUND input not specified for General Beam:   10230. Default used.
```

```
GBOUND    10101      0.8    1.0   0.6   1.0
```

Table 4.2-3 Default "Gbound" data assigned to general beams

When element groups are defined, the contents of the different groups are listed in the *.out* file, see Table 4.2-4. In the actual example, group no. *1000* is defined through geometry ID's, and the specified ID's are listed first (similar if the group was defined through material ID's).

Next, the elements, which are "members of" group no 1000 are listed, and finally, all nodal point, to which the element are connected to are listed.

```
-----     G R O U P   D E F I N I T I O N S     -----

G R O U P   label             : "Geometry Group no     1000"
Contains following Geometries:
                             10101   10228   10229   10230   10231   10251
                             10252   10352   15198   15199   16106   16129

                             17535   17600   17634

......elements  ............. :
                              5001    5002    5003    5004    5005    5006
                              5007    5008    5009    5010    5011    5012
                              5013    5014    5015    5016    5017    5018
                              5019    5020    5021    5022    5023    5024
                              5025    5026    5027    5028    5029    5030
                              5031    5032    5033    5034    5035    5036

                             78614   78615  755507  755508  726550  726551
                            726500  726501

......and nodes ............. :
                             54531   54834   54935   54930   54535   54536
                             54837   54938   54936   54538   54539   54841
                             54942   54939   54542   54543   54844   54950
                             54943   54550   54856   54957   54557   54558
                             54859   54961   54958   54561   54562   54863
```

Table 4.2-4 Print of group data: geometries, elements and nodes on the *.out* file.

The example shown in Figure 4.2-3, represents a first stage in a model repair procedure. The entire structure is still "structural", but members are grouped as specified above. By using the Edit/Clip/Group command in xfos, it's possible to visualise the different groups (include/exclude). The image to the right shows the full model, and by excluding all groups as seen in the "Specify Clip Group" menu, the image to the right appears.

If the NONSTRU command in Table 4.2-2 is activated (note that the # passives the command) only the elements in the image to the right remains structural, but loads are attracted on the full structure (image to the left).

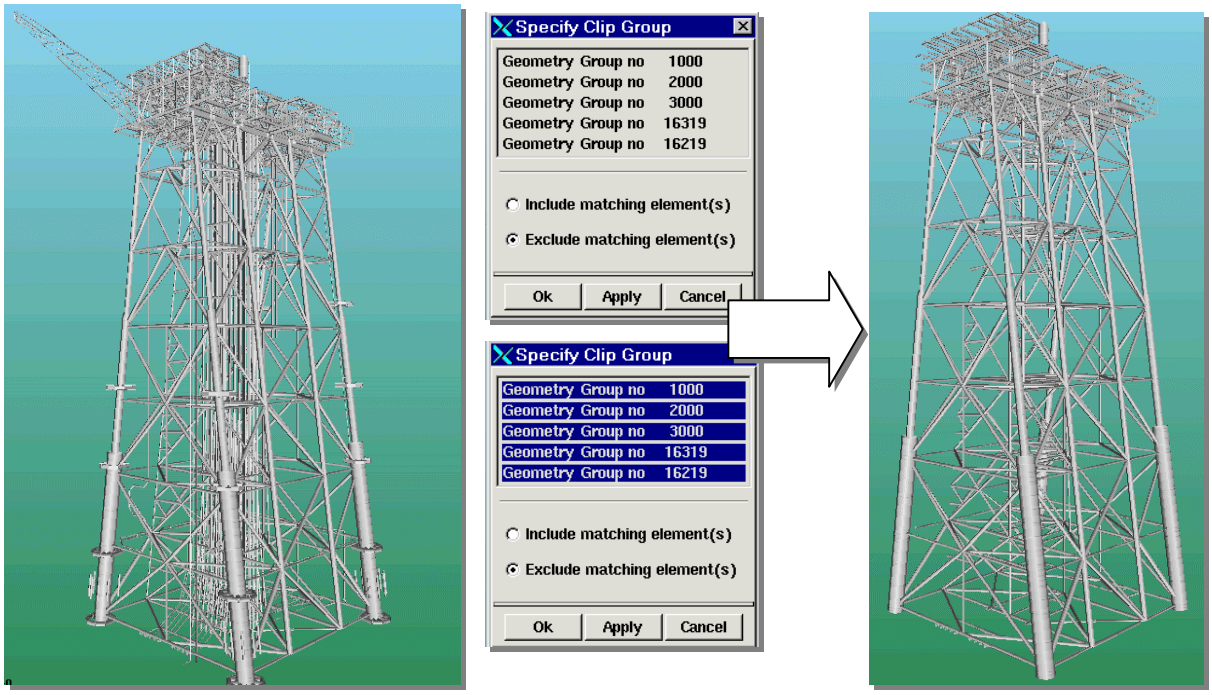


Figure 4.2-3 Edit / Clip / Group

Useful USFOS commands for the "model repair" work:

- GROUPDEF : Define element groups
- GROUPNOD : Add nodes to groups (guide loads towards nodes)
- NONSTRU : Define elements nonstructural
- STRUCTEL : Define elements structural (override NONSTRU for some elem.)
- LIN_ELEM : Define element linear elastic (with and without elastic buckling)

4.3. Joint classification / MSL joint characteristics

This write-up is a preliminary description of the implementation of MSL joint formulation in USFOS, for use with the β-release of the new feature.

The MSL equations are implemented with ductility limits and “post-rupture” unloading for tension loading, but with no ductility limits for compression loading.

Joint failure in tension invokes the “FRACTURE” option in USFOS.

Joint utilisation will be visualised by colour fringes in **Xfos**

The following shows the input required to include MSL joint characteristics in the analysis of a 2D K-frame. The input is described in more detail below.

```
' ------------------------------------------------------------
' Joint properties defined by MSL curves and plasticity formulation:
' ------------------------------------------------------------
'
 JNT_FORM    3       ! 0=beam stub  1=P-delta spring  3=plasticity model
 JNTCLASS    1       ! 0=OFF        i>0 : interval for (re)classification
'
'
'         nodex   chord1   chord2    Can   Rule  CapLevel GammaQf
 CHJOINT     7       6        7       0    MSL     mean     1.0
```

Table 4.3-1 USFOS control input activating MSL joint classification

Comparison between the USFOS analysis and alternative joint models and tests results are presented in Figure 4.3-2.

Each time joint (re)classification is performed, the following information is printed to the `.out` file.

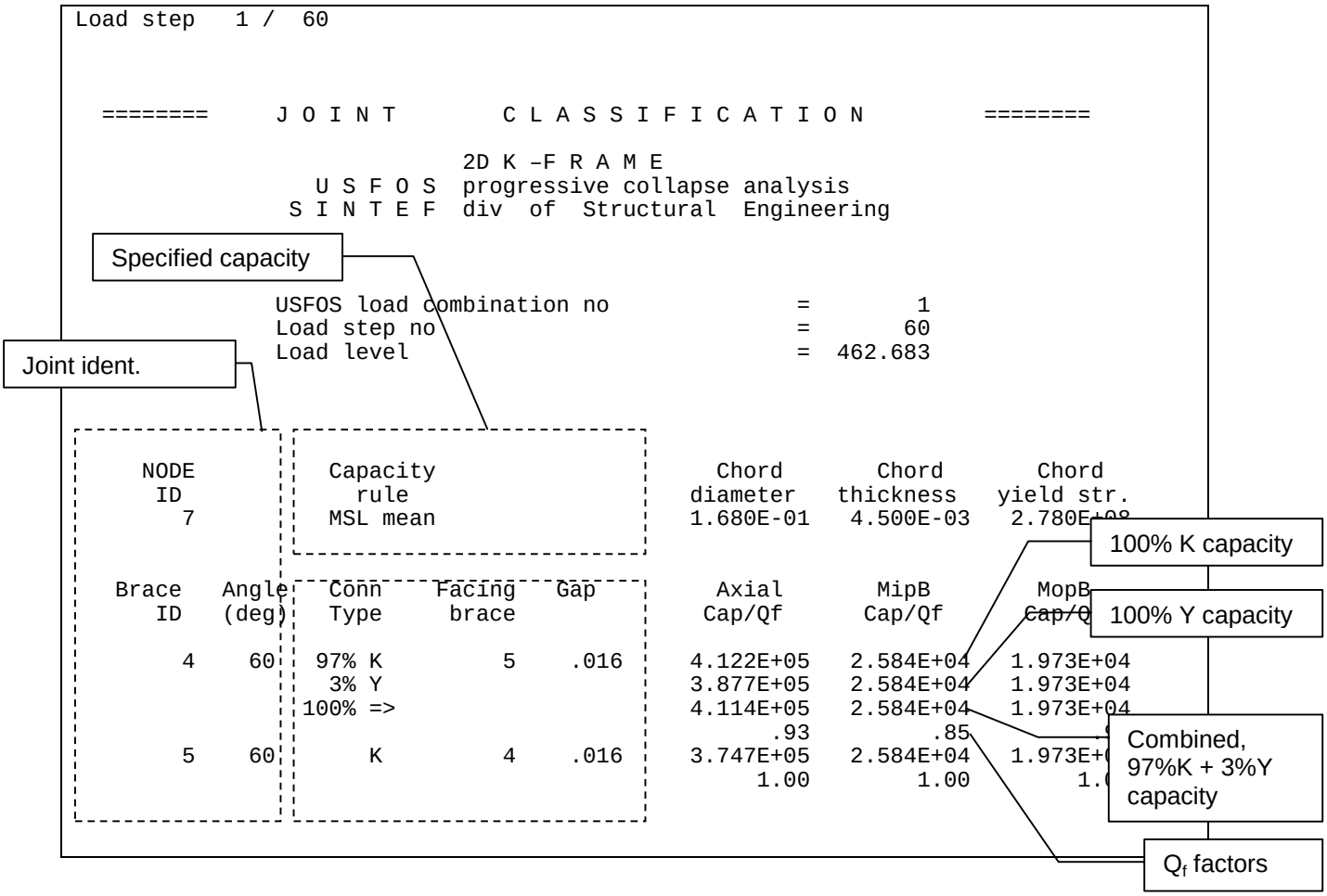


Table 4.3-2 Print from the MSL routines on the <res>.out file.

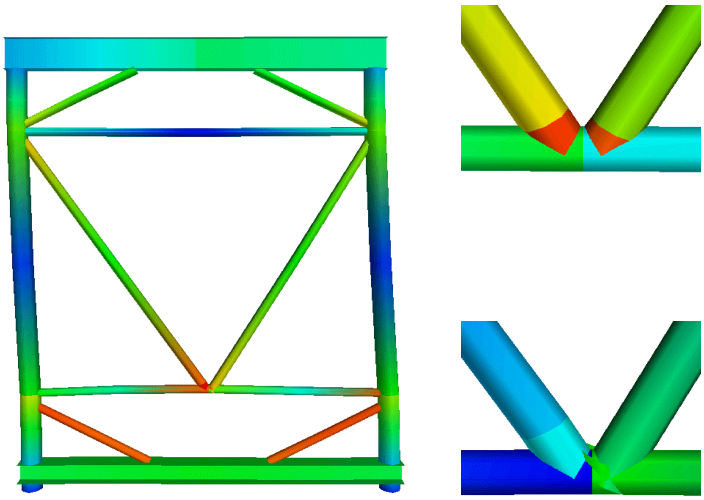


Figure 4.3-1 2D K-frame

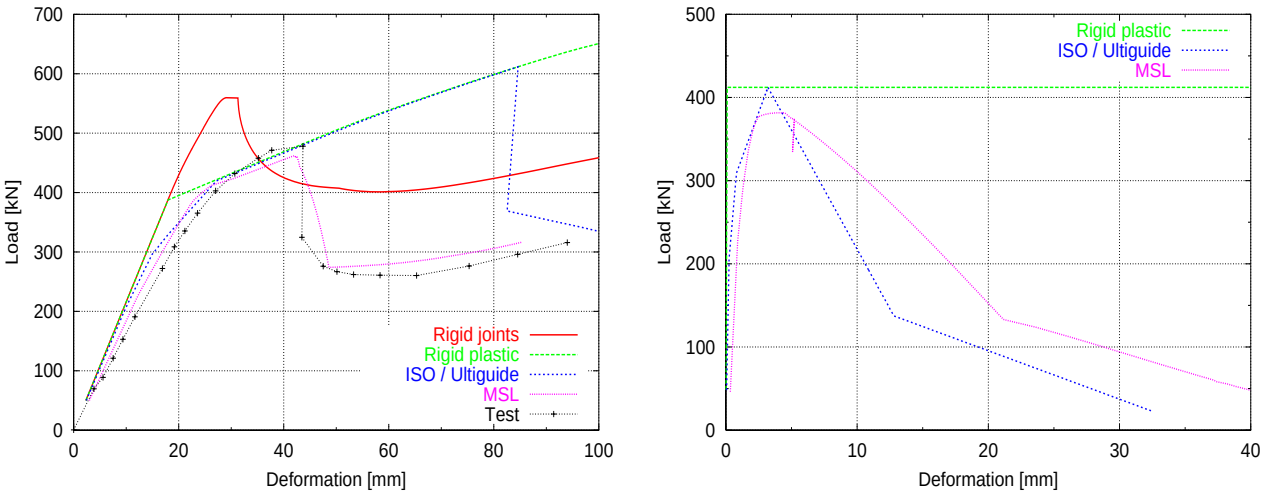


Figure 4.3-2 2D K-frame *Load – deformation* curves

5. New/modified input identifiers

Since last main release (7-6), following input identifiers are added/extended:

GROUPDEF : Define Element Group
GROUPNOD : Add nodes to Element group
NONSTRU : Nonstructural members Extended input
STRUCTEL : Structrual members (override NONSTRU)
LIN_ELEM : Linear elastic elements
CHJOINT : Extended input