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Abstract

POSTFOS is a computer program for interactive presentation of analysis results from the USFOS analysis system.

POSTFOS has been designed to provide extensive flexibility and user friendliness. The program is command oriented, with extensive HELP functions.

This manual gives a detailed introduction to the features of POSTFOS and the use of the program. For the experienced user, a compiled version of the program is provided.

XFOS is an interactive graphical postprocessor for presentation of USFOS analysis results by use of X-Y plots and 3D - images.

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1 INTRODUCTION

POSTFOS is a computer program for interactive presentation of analysis results from the USFOS analysis system.

POSTFOS has been designed to provide extensive flexibility and user friendliness. The main features of the program may be summarized as follows.

- Command oriented execution.
- Extensive built-in multilevel HELP functions.
- Multiple options for selection of print and plot.

This manual gives a detailed introduction to the features of POSTFOS and the use of the program. For the experienced user, a compiled version of the manual is found in Appendix A, POSTFOS Command Structure.

2 SYSTEM ARCHITECTURE

This chapter gives a general description of the USFOS program system.
The main parts of the system are briefly discussed, together with main features and functions of the POSTFOS program.

2.1 SYSTEM OVERVIEW

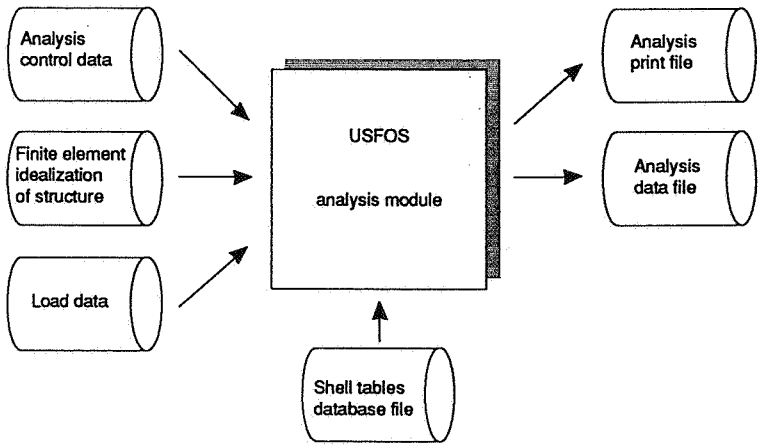
The USFOS program system consists of two separate modules: USFOS and POSTFOS.

USFOS performs all numerical calculations, and generates one print file and one data file of analysis results. The data file contains structure data, result data and intermediate data from the analysis. This file is used for restart of analyses, and as a result database for POSTFOS.

POSTFOS generates print files of selected analysis results, and files containing data for plots or files of deformed geometry data.

A database file containing shell tables is supplied with the program. This file is read when local flexibility at nodal joints is included in the analysis.

The different system files are described in Table T2.1.



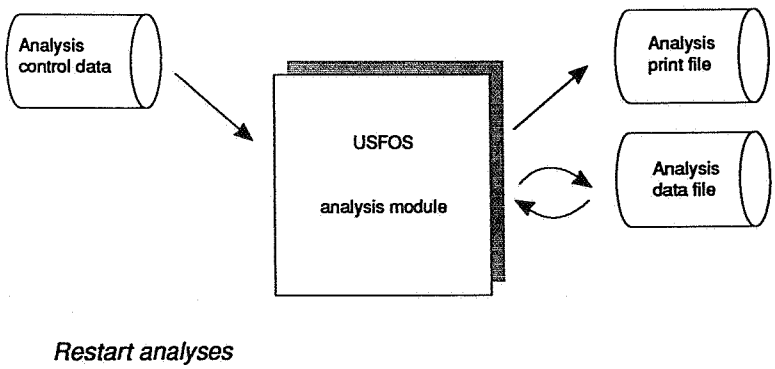


Figure 2.1 The USFOS analysis module.

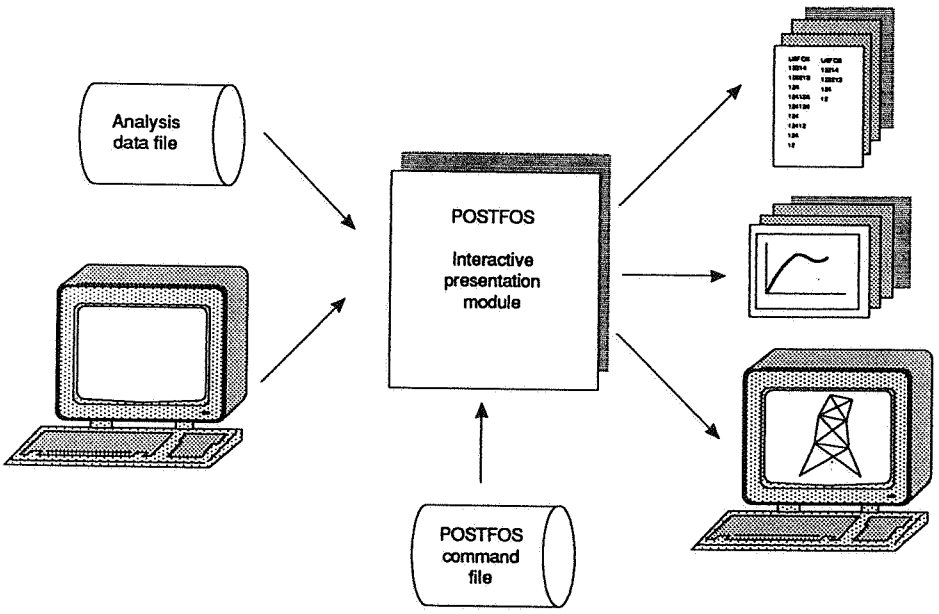


Figure 2.2 The POSTFOS presentation module.

Table T2.1 System files

System file	Type	Content
ANALYSIS CONTROL FILE	FEM	Control parameters for the USFOS nonlinear analysis. From one to ten data records. Generated manually. Formatted read only.
STRUCTURE MODEL FILE	FEM	Finite element idealization of the structure. Generated manually or by preprocessor program. Formatted read only.
LOAD FILE	FEM	Structural loads. Generated manually or by load generation program. Formatted read only.
SHELL TABLES DATABASE FILE	DAT	Data file of precalculated shell tables. Used for calculation of nodal joint flexibility. Unformatted read.
ANALYSIS PRINT FILE FILE	OUT	Print of analysis results : Input verification, global history output or output of each load step. Formatted write only.
ANALYSIS DATA FILE	RAF	Structure data, analysis results and restart data of each load step. Unformatted random access read and write.
POSTFOS COMMAND FILE	INCA	POSTFOS command set, parameter description and HELP texts. Unformatted read only.
POSTFOS PRINT FILE	PRI	Printed tables of USFOS analysis results. Formatted write only.
POSTFOS PLOT FILES	PLO	Plot data of USFOS analysis results. Formatted write only.
DEFORMED GEOMETRY FILES	GEO	Nodal coordinates and element topology of the deformed structure. Formatted write only.

2.2 MAIN FUNCTIONS

POSTFOS generates and presents printed tables and plot data of selected results from the Analysis Data File.

Result data may be presented as :

- Global history tables
- Result history tables
- Result load step tables
- Plot data tables
- Deformed geometry files

- Global history tables contain the following information :

  - Load level
  - Current stiffness
  - Energy absorbtion
  - Control displacement
  - Member plastification

- Result history tables may be generated for :

  - Nodal forces
  - Nodal displacements
  - Element forces
  - Element displacements
  - Element stresses
  - Element plastic displacements
  - Element interaction values

- Result tables for each load step may be generated for :

  - Nodal forces
  - Nodal displacements

- Element forces
- Element displacements
- Element stresses
- Element plastic displacements
- Element interaction values

- Plot tables may be generated for any combination of the following data :

  - Global load
  - Global displacement
  - Global energy
  - Global stiffness
  - Nodal forces
  - Nodal displacements
  - Element forces
  - Element displacements
  - Element stresses
  - Element plastic displacements
  - Element interaction values

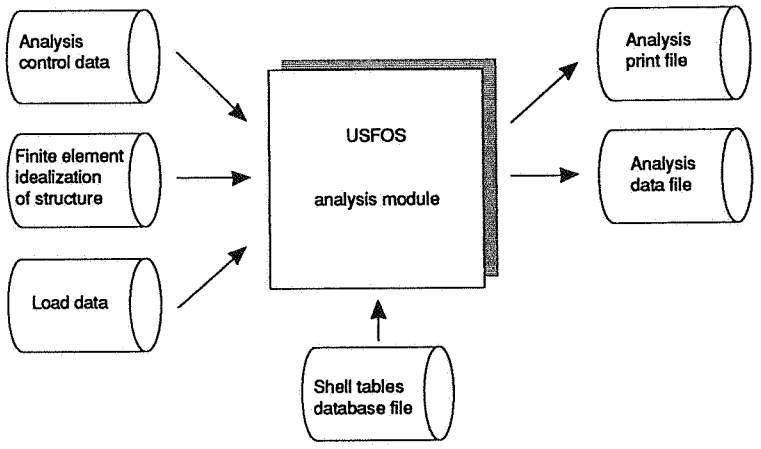
- Deformed geometry files with coordinate and topology information may be generated for load steps with *restart* data stored. (/2/ Section 4.7)

  The deformed geometry files contain the following data :

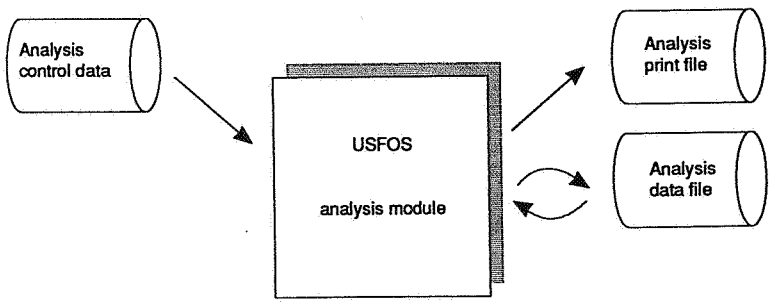
  - Deformed nodal coordinates
  - Element topology

  Plastic hinges are represented as additional nodes in the structure plot.

In addition to the above functions, the command structure of POSTFOS is prepared for graphic presentation of result data. These options have not been implemented yet. The command set also have options for printed tables of structure data. These options are not implemented.



Initial analysis



Restart analyses

Figure 2.1 The USFOS analysis module.

3 RESTRICTIONS AND REQUIREMENTS

3.1 RESTRICTIONS

The POSTFOS modules has certain limitations which the user should be aware of. These limitations are mainly due to computer capacity and functions not implemented.

- Computer capacity

  The POSTFOS modules has a limited number of computer words available for internal core storage allocation for the different matrices needed in a certain run. If a run requires more core storage than available in the current program version, the user must reduce the size of the problem or the program maintenance staff may increase the available program work space. If the program work space is increased, the actual core storage available in the computer should be taken into account. The need of a large program work space combined with a small core storage space in the computer may result in inefficient programs execution.

  In general, POSTFOS will require the same storage space as the analysis module, USFOS, but with some additional storage for internal POSTFOS arrays.

  Because the POSTFOS modules may generate several files, necessary secondary storage space must be available.

- Functions not implemented

  The command structure of POSTFOS is prepared for graphic presentation of result data, but these options are not implemented yet.

  The command set also have options for printed tables of structure data. These options are not implemented yet.

  The commands executing these functions "(not yet implemented)"

3.2 COMPUTER REQUIREMENTS

The "target" computer for the POSTFOS Presentation Modules is a typical supermini, i.e., computers in the VAX / ND-500/5000 family.

Computer requirements:

- 32 bit wordlength
- Virtual memory

The POSTFOS modules has been written in standard FORTRAN-77, and the size is:

- Approximately 25000 lines of source code exclusive standard software
- About 50 percent comment lines

4 PROGRAM USE

4.1 THE USER INTERFACE

4.1.1 The command handling system

The interactive communication with the user is handled by the general purpose command processor INCA, ref /6/. INCA´s user´s guide (Appendix D) provides necessary and sufficient information to the novice user. The main facilities in the INCA system are :

- A user input line consists of a command field and a parameter field.
- Commands may be abbreviated provided nonambiguity is maintained.
- Parameters not given on the comand line (inline) are prompted.
- Parameters may be assigned default values.
- Parameter range may be defined.
- Parameter valid entries may be defined.
- Built-in user´s manual by multilevel HELP functions.
- Macro definition facility.
- Editing facilities on the input command line.

The commands are composed of a primary command with up to three subcommands separated from the primary command by hyphens. Each command are given names intended to explain which program function the command activates.

The parameter field may contain several parameters. Parameters may be of four different types: *Integer, Real, Name, Text*. Parameters of Integer or Real type may be entered as single items (scalars) or as multiple items (vectors) where the individual values are separated by slashes (/).

Comma or blanks are used as separator between individual parameters. Superfluous blanks as delimiter are ignored. Trailing parameters left out from the command line are requested by a leading text. Skipping a parameter field by giving ,, inline or *CR (carriage return)* on demand , are interpreted as request for

default value. In cases where default value is not defined, INCA will demand the parameter by leading text until it is specified.

INCA offers three simple ways for correction of typing errors or similar regrettable user input; *delete character, delete parameter, delete command.* The desired action is flagged by typing one or more of the *editing* characters:

< means *delete the preceeding character*
$ means *delete the preceeding parameter*
! means *delete the command*

Delete the preceeding character can be used repeatedly, e.g.,

COOO<RDNI<<INATES

will be interpreted as:

COORDINATES

A parameter field terminated with $ will be disregarded, and can be immediately retyped.

If a ! is given any time within a command field or a parameter field the command and its parameters will be cancelled, and the user can retype the whole command immediately or on a new line after giving *CR (carriage return)*.

4.2 THE COMMAND SET

The command structure of POSTFOS is prepared for later extension with graphic presentation of result data, and additional printed tables of structure data. These options are not implemented yet, and are marked by an asterisk (*) in the following command overview.

The commands are divided into command groups as follows :

- *File handling*

  The commands in this group are used to make external files available to the program. There are also commands for listing of currently open files and listing of the file contents.

  OPEN-FILE
  LIST-OPEN-FILES
  LIST-FILE-CONTENT

- *Print Commands*

  These commands are used for printing result tables.

  DEFINE-HISTORY-TABLE
  DEFINE-STEP-TABLE
  DEFINE-STRUCTURE-TABLE *)

  PRINT-HISTORY
  PRINT-STEP
  PRINT-STRUCTURE *)

- *Main plot commands*

  These command are used to generate result tables prepared for plotting.
  In a later extension, the plots will be displayed on the currently specified display device or stored in the picture buffer for further handling as pseudo

pictures.

DEFINE-X-AXIS
DEFINE-Y-AXIS
DEFINE-STRUCTURE-PLOT

PRINT-PLOTFILE
PRINT-STRUCTURE-PLOT
DRAW *)
PAGE *)

- *Entity set commands*

The commands in this group are used to group data entities together in *entity sets*. The entity sets are used in commands to print information of structural data or analysis results. The specified print command is executed for all data entities in the *set*. The content of one set can be added to, or removed from, other sets with the following commands :

CREATE-ENTITY-SET
APPEND-ENTITY-SET
REMOVE-ENTITY-SET
CLEAR-ENTITY-SET
LIST-ENTITY-SET
DELETE-ENTITY-SET

- *Data Specification Commands*

The commands in this group are activated as sub-commands of the DEFINE-...-... commands and the APPEND/REMOVE-ENTITY-SET commands. Depending on the main command, some of the specification commands will be repeated. To terminate the data specification, type <!>.

SPECIFY-SINGLE-ENTITY
SPECIFY-ENTITY-GROUP
SPECIFY-SET

SPECIFY-DATA
SPECIFY-NODE
SPECIFY-ELEMENT
SPECIFY-EVENT-PRINT
SPECIFY-PRINT-CODE
SPECIFY-SCALING-FACTOR

- *Set-up Commands*

The commands in this group may be used any time during an execution of the program, whenever the user want to change some of the specification settings.

SET-PAGE-SIZE
SET-DISPLAY-DEVICE *)
SET-REMOTE-DEVICE *)
SET-VIEW-PARAMETERS *)
SET-GRID-TYPE *)
SET-PICTURE-TITLES *)
SET-AUTO-DISPLAY *)

- *Picture buffer handling commands*

These features are not implemented in the current version. In a later extension, the commands in this group make it possible for the user to manipulate the pictures in the pseudo picture buffer.

SET-CURRENT-PICTURE *)
DISPLAY-PICTURE *)
PLOT-PICTURE *)
DELETE-PICTURE *)
WRITE-PICTURE *)
READ-PICTURE *)
LIST-PICTURE-BUFFER-CONTENT *)
ASSIGN-PICTURE-PARTS *)
SELECT-COLOUR *)

- *Program termination*

  EXIT
  QUIT

4.3 THE PICTURE HANDLING SYSTEM

The command structure of POSTFOS is prepared for later extension with graphic presentation of result data. Functions for general picture handling is implemented in the program, to be activated when graphics are introduced.

4.3.1 Picture composition

Each plot produced by POSTFOS is divided into different segments.
A plot is generally composed of the following picture segments:

- Frame
- Text
- Coordinate system
- Coordinate system grid
- Main curve
- Additional curves (not relevant for all plots)

The user may compose the final picture by turning the display status ON or OFF for each segment.

4.3.2 Pseudo pictures and displayed pictures

The creation of a plot is carried out in two steps. The first step is the creation of plot information which is graphical device independent. This is the so-called pseudo picture, composed of pseudo segments. A pseudo picture can be displayed repeatedly at different graphical devices. This means that the user has the possibility to examine the plot at a graphic terminal, and then, if wanted, send it to a plotter without generating the picture once more.

The pseudo pictures may also be stored on file for later plotting on a plotter by use of a special purpose program, GSL-SHOW, ref /7/.
The pseudo pictures stored on file may also be restored by POSTFOS.

4.3.3 The picture buffer

The pseudo pictures are stored internally in a buffer, called the *picture buffer*. In the present version it is possible to store up to 32 pictures in the buffer simultaneously. The following functions are available for picture buffer manipulation.

- Changing current picture, ie, the picture which the next buffer handling commands will be related to.
- Plot current picture on a remote device.
- Display current picture on an on-line device.
- Delete current picture from the picture buffer.
- Store the current picture on a GSL plot file.
- Read a picture from the plot file into the picture buffer.
- List the content of the picture buffer.

4.3.4 External storage of pictures

As indicated above it is possible to store the pictures on file for later processing. There are three different options.

a) Store the pseudo pictures on a POSTFOS plot file.
   The pseudo pictures are copied from the picture buffer to the plot file. All information needed to display the picture on any graphical device are also stored.

   A special purpose program is available for plotting the pictures stored on a POSTFOS plot file on a remote plotter, GSL-SHOW, ref /7/.

b) Use a file as the remote device.
This is maybe the simplest way of off-line plotting. The plots are stored on file by using the remote display facility. Instead of giving the line number of a remote plotter, the user must connect a FORTRAN logical file unit to the session prior to the program execution, and then use this unit as the line number of the remote device. The file may later on be copied to the plotter by use of a COPY command in the computer operating system.

c) Use of the META driver or the FILE driver.
The files may be further processed by the programs METASHOW or FILESHOW respectively. This is GPGS-F supported facilities and will not be explained here. The user should consult the GPGS-F documentation, ref /8/.

5 OUTPUT

5.1 OUTPUT FROM THE POSTFOS MODULE

This chapter gives a brief description of output data from the POSTFOS module. Output from the POSTFOS module is of three main types:

- Printed tables of analysis results.
  The presentation module will generate 3 types of tables :
  - Global history results.
  - Result histories of selected data.
  - Load step results of selected data.
- Printed tables of plot data.
  The presentation module will generate 3 types of plot data :
  - Global results vs. global result
  - Global results vs. node-/element-results
  - Node-/element-result vs. Node-/element-results
- Deformed geometry data
  - Deformed nodal coordinates
  - Element connectivity

The printed output from POSTFOS have been designed for:

- Compactness
- Readability

For the present, no graphic options are implemented in POSTFOS. Instead, the program generates tables of plot data and deformed geometry data in symbolic format, using a format that is easily adapted to existing graphic systems. These tables may then be read into general plotting programs or FEM plotting programs.

Deformed geometry files can be created for all load steps where *restart* data is stored. (/2/ Section 4.7)

For a later extension, the command structure of POSTFOS has already been prepared for graphic presentation of result data, with options for storage of generated pictures on a secondary file for later retrieval. (This facility will make batch plotting possible.)

5.1.1 POSTFOS Print File

Printed tables are written to the POSTFOS Print File.

A default print file with the following filename is opened when POSTFOS is started :

<filename> PRI

where

<filename> = Filename of the Analysis Data file (RAF).

On computers that support file opening within the program, the filename and filetype can be changed during the POSTFOS session by the OPEN-FILE command. (Section 7.3)

To have data printed to the screen, execute the OPEN-FILE command with TERMINAL as print file name. Note that results written to terminal will not automatically be written to file.

The LIST-FILE-CONTENT command will list the content of a specified file on the screen.

5.1.2 POSTFOS Plot File

Tables of plot data are written to the POSTFOS Plot File.

A default plot file with the following filename is opened when POSTFOS is started :

‹filename› PLO

where

‹filename› = Filename of the Analysis Data file (RAF).

On computers that support file opening within the program, the filename and filetype can be changed during the POSTFOS session by the OPEN-FILE command. (Section 7.3)

The LIST-FILE-CONTENT command will list the content of a specified file on the screen.

5.1.3 Deformed Geometry File

Deformed structure data are written to the Deformed Geometry File(s).

On computers that support file opening within the program, one file will be generated for each specified load step. On other systems, all specified steps will be printed on one single file.

If several deformed geometry files are created, the filenames will have the following syntax :

<filename>-<Lcs>-<Lst> GEO

where

<filename> = Filename of the Analysis Data File (RAF).
This prefix can be changed by the OPEN-FILE command.
(Section 7.3)

<Lcs> = Load case/combination number

<Lst> = Load step

The filename can be changed during the POSTFOS session by the OPEN-FILE command. (Section 7.3)

If only one deformed geometry file is created, the filename will have the following syntax :

<filename> GEO

In this case, each load step is identified by the following heading :

```
*******************************     Load case: <Lcs>
*  DEFORMED  GEOMETRY  DATA   *     Load step: <Lst>
*******************************
```

5.2 GLOBAL HISTORY TABLES

5.2.1 Load History

```
*****************************************
*        GLOBAL   LOAD   HISTORY        *
*****************************************
```

Load comb.	Load step	Load level	Current stiff.	Control displ.	Energy absorb.
1	1	1.000	1.000	4.380E-03	8.760E+01
1	2	2.000	1.000	8.760E-03	3.504E+02
1	3	3.000	1.000	1.314E-02	7.885E+02
1	4	4.000	1.000	1.752E-02	1.402E+03
1	5	5.000	1.000	2.190E-02	2.190E+03
1	6	5.500	1.000	2.409E-02	2.650E+03
1	7	5.923	1.000	2.595E-02	3.074E+03
1	8	6.099	.948	2.676E-02	3.270E+03
1	9	6.489	.887	2.869E-02	3.754E+03
1	10	6.500	.865	2.874E-02	3.769E+03
1	11	6.535	.865	2.892E-02	3.815E+03
1	12	6.585	.837	2.918E-02	3.884E+03
1	13	6.609	.836	2.931E-02	3.917E+03
1	14	6.631	.785	2.943E-02	3.949E+03
1	15	6.642	.549	2.952E-02	3.972E+03

Figure 5.1 Load history

The Load History is a table of the load level, structural stiffness and energy absorption during the loading history.

USFOS load combination : Load combination number, or basic load case number (/2/, Sections 4.1 and 6.3.D,F).

Load step : Number of times the initial load has been incremented.

Load level : Relative load level of the current load combination and load step. The load level is "local" within each combination, starting from zero when a new load combination is specified.

Current stiffness : Structural stiffness. The initial stiffness is 1.0. Decreasing value represents a decreasing stiffness in the structure (/2/, Section 4.2.1).

Control displacement : Equivalent displacement of the structure. The displacement is calculated as a balanced average of selected displacements (/2/, Sections 4.2.2 and 6.3.E).

Energy absorption : Accumulated external work absorbed by the structure. This is the total energy of all load combinations.

5.2.2 Global History Table

```
*****************************************
*        GLOBAL   LOAD   HISTORY        *
*****************************************
```

Load comb.	Load step	Load level	Current stiff.	Control displ.	Energy absorb.	Elem. no.	Event type	Node no.
1	1	1.000	1.000	4.380E-03	8.760E+01			
1	2	2.000	1.000	8.760E-03	3.504E+02			
1	3	3.000	1.000	1.314E-02	7.885E+02			
1	4	4.000	1.000	1.752E-02	1.402E+03			
1	5	5.000	1.000	2.190E-02	2.190E+03			
1	6	5.500	1.000	2.409E-02	2.650E+03			
1	7	5.923	1.000	2.595E-02	3.074E+03			
						6	PLAST	END1
1	8	6.099	.948	2.676E-02	3.270E+03			
						8	PLAST	END2
1	9	6.489	.887	2.869E-02	3.754E+03			
						1	PLAST	END2
1	10	6.500	.865	2.874E-02	3.769E+03			
1	11	6.535	.865	2.892E-02	3.815E+03			
						3	PLAST	END1
1	12	6.585	.837	2.918E-02	3.884E+03			
1	13	6.609	.836	2.931E-02	3.917E+03			
						3	PLAST	MID
1	14	6.631	.785	2.943E-02	3.949E+03			
						3	UNLOD	END1
						1	PLAST	END1
						1	PLAST	MID
						1	AXIAL	MID
						2	PLAST	MID
						2	AXIAL	MID
1	15	6.642	.549	2.952E-02	3.972E+03			
						3	PLAST	END2

Figure 5.2 Global history

The Global History Table is a table of load level, structural stiffness and energy absorption during the loading history. In addition, all plastic hinges introduced or removed is listed at each load step.

The data are as described in section 5.2,1, except

Element number : Element identification number.

Event position : Position where a plastic hinge is formed/removed (/2/, Sections 3.1 and 4.4).
END1: First element end

END2: Second element end
MID : Element midspan
JNT1: Joint at first element end
JNT2: Joint at second element end

Event type : Change of element status.
YIELD: The forces has reached first yield of the cross section, and a plastic hinge is formed. (/2/, Section 4.3)
PLAST: The forces has reached the full plastic capacity of the cross section.
UNLOD: The element has unloaded and the cross section has returned to the elastic state.
AXIAL: The element forces have reached the full plastic tension capacity of the member. A membrane element is introduced, accounting for geomeric stiffness of the member.
FRACT: Fracture is detected in the member.
JOINT: The full capacity of the joint has been reached and the joint is yielding.

MIN STEP LENGTH : Attempt to scale the load step below the minimum size specified by the user.
(/2/, Section 4.2 and 6.3.D)

MAX DISPL INCR : Load step scaled due to large displacement increments.
(/2/, Section 4.2 and 6.3.D)

5.3 RESULT TABLES

5.3.1 Nodal forces

Nodal forces may be printed at specified load steps or for the whole loading history.

```
*******************************     Load case:   1
*     NODAL    FORCES         *     Load step:  15
*******************************     Load level: 6.64
```

Node	X-force	Y-force	Z-force	X-moment	Y-moment	Z-moment
1	2.657E+05	.000E+00	1.989E-11	.000E+00	4.073E-11	.000E+00
2	-1.885E-08	.000E+00	-9.576E-11	.000E+00	1.515E-10	.000E+00
3	1.485E-08	.000E+00	8.602E-11	.000E+00	-1.006E-10	.000E+00
4	3.854E-11	.000E+00	-1.057E-10	.000E+00	1.799E-11	.000E+00
5	4.458E-11	.000E+00	-2.109E-10	.000E+00	1.234E-11	.000E+00
6	2.817E-11	.000E+00	3.942E-11	.000E+00	-1.238E-13	.000E+00
7	-5.009E-12	.000E+00	-4.033E-11	.000E+00	3.534E-12	.000E+00
8	7.240E-11	.000E+00	-3.433E-13	.000E+00	1.026E-12	.000E+00
9	1.746E-12	.000E+00	5.463E-12	.000E+00	6.418E-14	.000E+00
10	-4.183E-11	.000E+00	-5.640E-12	.000E+00	-5.381E-12	.000E+00
11	-2.193E-11	.000E+00	-1.540E-11	.000E+00	9.068E-13	.000E+00
12	-1.371E+05	.000E+00	-7.307E+05	.000E+00	3.789E-12	.000E+00
13	-1.285E+05	.000E+00	7.307E+05	.000E+00	1.044E-11	.000E+00

Figure 5.3a Nodal forces at load step(s)

```
*****************************************
*      NODAL   FORCE   HISTORY           *
*****************************************
```

Load case	Load step	Load level	1 X-force	12 X-force	13 X-force	13 Z-force
1	1	1.000E+00	4.000E+04	-2.000E+04	-2.000E+04	1.100E+05
1	2	2.000E+00	8.000E+04	-4.023E+04	-3.977E+04	2.200E+05
1	3	3.000E+00	1.200E+05	-6.070E+04	-5.930E+04	3.300E+05
1	4	4.000E+00	1.600E+05	-8.140E+04	-7.860E+04	4.400E+05
1	5	5.000E+00	2.000E+05	-1.023E+05	-9.767E+04	5.500E+05
1	6	5.500E+00	2.200E+05	-1.129E+05	-1.071E+05	6.051E+05
1	7	5.923E+00	2.369E+05	-1.219E+05	-1.150E+05	6.516E+05
1	8	6.099E+00	2.440E+05	-1.255E+05	-1.185E+05	6.710E+05
1	9	6.489E+00	2.596E+05	-1.338E+05	-1.257E+05	7.138E+05
1	10	6.500E+00	2.600E+05	-1.341E+05	-1.259E+05	7.151E+05
1	11	6.535E+00	2.614E+05	-1.348E+05	-1.266E+05	7.189E+05
1	12	6.585E+00	2.634E+05	-1.359E+05	-1.275E+05	7.244E+05
1	13	6.609E+00	2.644E+05	-1.364E+05	-1.279E+05	7.271E+05
1	14	6.631E+00	2.652E+05	-1.369E+05	-1.283E+05	7.294E+05
1	15	6.642E+00	2.657E+05	-1.371E+05	-1.285E+05	7.307E+05

Figure 5.3b Nodal force history

5.3.2 Nodal displacements

Nodal displacements may be printed at specified load steps or for the whole loading history.

```
*******************************     Load case:   1
*   NODAL   DISPLACEMENTS     *     Load step:  15
*******************************     Load level: 6.64
```

Node	X-displ.	Y-displ.	Z-displ.	X-rot.	Y-rot.	Z-rot.
1	2.952E-02	.000E+00	1.994E-03	.000E+00	1.356E-03	.000E+00
2	2.950E-02	.000E+00	-5.940E-05	.000E+00	1.354E-03	.000E+00
3	2.950E-02	.000E+00	-2.113E-03	.000E+00	1.356E-03	.000E+00
4	2.575E-02	.000E+00	1.977E-03	.000E+00	3.329E-03	.000E+00
5	2.575E-02	.000E+00	-2.088E-03	.000E+00	3.332E-03	.000E+00
6	2.007E-02	.000E+00	-3.782E-05	.000E+00	2.161E-03	.000E+00
7	1.498E-02	.000E+00	1.460E-03	.000E+00	2.138E-03	.000E+00
8	1.499E-02	.000E+00	-1.539E-03	.000E+00	2.093E-03	.000E+00
9	1.045E-02	.000E+00	-3.514E-05	.000E+00	7.760E-04	.000E+00
10	6.793E-03	.000E+00	3.470E-04	.000E+00	7.072E-03	.000E+00
11	6.838E-03	.000E+00	-4.001E-04	.000E+00	7.142E-03	.000E+00
12	.000E+00	.000E+00	.000E+00	.000E+00	9.134E-03	.000E+00
13	.000E+00	.000E+00	.000E+00	.000E+00	9.204E-03	.000E+00

Figure 5.4a Nodal displacements at load step(s)

```
*****************************************
*    NODAL   DISPLACEMENT   HISTORY      *
*****************************************
```

Load case	Load step	Load level	1 X-displ.	4 X-displ.	6 X-displ.	7 X-displ.
1	1	1.000E+00	4.380E-03	3.815E-03	2.969E-03	2.205E-03
1	2	2.000E+00	8.760E-03	7.629E-03	5.939E-03	4.410E-03
1	3	3.000E+00	1.314E-02	1.144E-02	8.908E-03	6.615E-03
1	4	4.000E+00	1.752E-02	1.526E-02	1.188E-02	8.820E-03
1	5	5.000E+00	2.190E-02	1.908E-02	1.485E-02	1.103E-02
1	6	5.500E+00	2.409E-02	2.098E-02	1.633E-02	1.213E-02
1	7	5.923E+00	2.595E-02	2.260E-02	1.759E-02	1.306E-02
1	8	6.099E+00	2.676E-02	2.331E-02	1.815E-02	1.349E-02
1	9	6.489E+00	2.869E-02	2.501E-02	1.953E-02	1.456E-02
1	10	6.500E+00	2.874E-02	2.506E-02	1.957E-02	1.459E-02
1	11	6.535E+00	2.892E-02	2.522E-02	1.969E-02	1.469E-02
1	12	6.585E+00	2.918E-02	2.545E-02	1.986E-02	1.483E-02
1	13	6.609E+00	2.931E-02	2.557E-02	1.995E-02	1.489E-02
1	14	6.631E+00	2.943E-02	2.567E-02	2.002E-02	1.495E-02
1	15	6.642E+00	2.952E-02	2.575E-02	2.007E-02	1.498E-02

Figure 5.4b Nodal displacement history

5.3.3 Element forces

Element forces may be printed at specified load steps or for the whole loading history. The forces are listed for both element ends and for element midspan.

```
*******************************     Load case:   1
*    ELEMENT    FORCES        *     Load step:  15
*******************************     Load level: 6.64

Elem. Pos.    X-force    Y-force    Z-force   X-moment   Y-moment   Z-moment

   3  NOD1  1.625E+05   .000E+00 -1.536E+01   .000E+00 -1.449E+01   .000E+00
   3  MID  -1.625E+05   .000E+00 -5.850E+01   .000E+00 -4.599E+01   .000E+00
   3  NOD2 -1.625E+05   .000E+00  1.536E+01   .000E+00  4.603E+01   .000E+00

   4  NOD1  1.625E+05   .000E+00  1.698E+01   .000E+00 -1.255E+01   .000E+00
   4  MID  -1.625E+05   .000E+00 -1.698E+01   .000E+00 -8.998E+00   .000E+00
   4  NOD2 -1.625E+05   .000E+00 -1.698E+01   .000E+00 -1.966E+01   .000E+00
```

Figure 5.5a Element forces at load step(s)

```
*****************************************
*     ELEMENT   FORCE   HISTORY         *
*****************************************

Load   Load      Load          3           3           1           1
case   step      level      Node 1      Node 1      Node 1      Node 1
                             X-force     Y-moment    X-force     Y-moment

  1      1     1.000E+00   2.449E+04   2.988E+01  -2.449E+04   1.810E+00
  1      2     2.000E+00   4.900E+04   5.774E+01  -4.897E+04   2.510E+00
  1      3     3.000E+00   7.351E+04   8.351E+01  -7.344E+04   2.121E+00
  1      4     4.000E+00   9.803E+04   1.071E+02  -9.790E+04   6.629E-01
  1      5     5.000E+00   1.226E+05   1.285E+02  -1.224E+05  -1.852E+00
  1      6     5.500E+00   1.348E+05   1.380E+02  -1.346E+05  -3.632E+00
  1      7     5.923E+00   1.452E+05   1.456E+02  -1.449E+05  -5.361E+00
  1      8     6.099E+00   1.494E+05   1.485E+02  -1.493E+05  -5.933E+00
  1      9     6.489E+00   1.590E+05   1.547E+02  -1.589E+05  -8.020E+00
  1     10     6.500E+00   1.593E+05   1.554E+02  -1.591E+05  -1.195E+01
  1     11     6.535E+00   1.602E+05   1.576E+02  -1.599E+05  -2.409E+01
  1     12     6.585E+00   1.614E+05   1.019E+02  -1.610E+05  -3.345E+01
  1     13     6.609E+00   1.619E+05   7.472E+01  -1.616E+05  -3.796E+01
  1     14     6.631E+00   1.622E+05   3.975E+01  -1.623E+05  -5.727E+01
  1     15     6.642E+00   1.625E+05  -1.449E+01  -1.623E+05  -5.727E+01
```

Figure 5.5b Element force history

Pos: Position where forces are calculated

NOD1: First element end
NOD2: Second element end
MID : Element midspan

5.3.4 Element stresses

Element stresses are only available as load step output. The stresses are calculated in local x-, y- and z-directions for both element ends and for element midspan.

```
   ******************************      Load case:   1
   *     ELEMENT    STRESSES     *     Load step:  15
   ******************************      Load level: 6.64

  NOTE : Stresses are based on plastic cross section properties
         NOMINAL STRESS  =  ABS(AXIAL) + SQRT(Y*Y + Z*Z)

   Elem.    Pos.      Axial       Y-axis       Z-axis       Nominal

      3    NOD1     2.466E+08   -6.945E+05     .000E+00    2.473E+08
      3    MID     -2.466E+08   -2.204E+06     .000E+00    2.488E+08
      3    NOD2    -2.466E+08    2.206E+06     .000E+00    2.488E+08

      4    NOD1     2.467E+08   -6.012E+05     .000E+00    2.473E+08
      4    MID     -2.467E+08   -4.312E+05     .000E+00    2.471E+08
      4    NOD2    -2.467E+08   -9.421E+05     .000E+00    2.476E+08
```

Figure 5.6a Element stresses at load step(s)

```
   ****************************************
   *       ELEMENT   STRESS   HISTORY       *
   ****************************************

  NOTE : Stresses are based on plastic cross section properties

    Load    Load       Load          3           3           1           1
    case    step       level      Node 1      Node 1      Node 1      Node 1
                                    Axial      Y-bend.      Axial      Y-bend.

      1       1     1.000E+00   3.717E+07   1.432E+06  -3.717E+07   8.673E+04
      1       2     2.000E+00   7.436E+07   2.767E+06  -7.432E+07   1.203E+05
      1       3     3.000E+00   1.116E+08   4.001E+06  -1.115E+08   1.016E+05
      1       4     4.000E+00   1.488E+08   5.133E+06  -1.486E+08   3.177E+04
      1       5     5.000E+00   1.860E+08   6.157E+06  -1.857E+08  -8.872E+04
      1       6     5.500E+00   2.046E+08   6.615E+06  -2.042E+08  -1.741E+05
      1       7     5.923E+00   2.204E+08   6.977E+06  -2.199E+08  -2.569E+05
```

Figure 5.6b Element stress histories.

Pos: Position where stresses are calculated

NOD1: First element end
NOD2: Second element end
MID : Element midspan

Note: The element stresses MUST NOT be used as "unity check".
Control of the element stress level at a given load step gives no information about the stress history prior to that load step, and gives no indication as to which elements are more heavily stressed.

5.3.5 Element displacements

Element displacements may be printed at specified load steps or for the whole loading history. The displacements are listed for both element ends and for element midspan.

```
*******************************     Load case:   1
*   ELEMENT   DISPLACEMENTS   *     Load step:  15
*******************************     Load level: 6.64

Elem. Pos.   X-displ.   Y-displ.   Z-displ.    X-rot.     Y-rot.     Z-rot.

   3  NOD1  1.434E-04   .000E+00  1.388E-04   .000E+00  8.222E-04   .000E+00
   3  MID  -1.169E-03   .000E+00 -3.512E-04   .000E+00 -3.860E-04   .000E+00
   3  NOD2 -2.443E-03   .000E+00  9.486E-05   .000E+00 -3.460E-04   .000E+00

   4  NOD1   .000E+00   .000E+00   .000E+00   .000E+00 -2.159E-06   .000E+00
   4  MID  -1.265E-03   .000E+00 -2.012E-05   .000E+00  1.908E-05   .000E+00
   4  NOD2 -2.530E-03   .000E+00   .000E+00   .000E+00 -6.994E-05   .000E+00
```

Figure 5.7a Element displacements at load step(s)

```
*****************************************
*    ELEMENT   DISPLACEMENT   HISTORY    *
*****************************************

Load   Load      Load          3           3           1           1
case   step      level       Node 1      Node 1      Node 1      Node 1
                            X-displ.     Y-rot.     X-displ.     Y-rot.

  1      1     1.000E+00   .000E+00   1.219E-04   .000E+00  -5.404E-05
  1      2     2.000E+00   .000E+00   2.436E-04   .000E+00  -1.081E-04
  1      3     3.000E+00   .000E+00   3.649E-04   .000E+00  -1.623E-04
  1      4     4.000E+00   .000E+00   4.861E-04   .000E+00  -2.166E-04
  1      5     5.000E+00   .000E+00   6.069E-04   .000E+00  -2.712E-04
  1      6     5.500E+00   .000E+00   6.672E-04   .000E+00  -2.986E-04
  1      7     5.923E+00   .000E+00   7.182E-04   .000E+00  -3.219E-04
  1      8     6.099E+00   .000E+00   7.394E-04   .000E+00  -3.309E-04
  1      9     6.489E+00   .000E+00   7.858E-04   .000E+00  -3.529E-04
  1     10     6.500E+00   .000E+00   7.868E-04   .000E+00  -3.492E-04
  1     11     6.535E+00   .000E+00   7.898E-04   .000E+00  -3.376E-04
  1     12     6.585E+00   1.218E-05  7.947E-04   .000E+00  -2.883E-04
  1     13     6.609E+00   1.814E-05  7.972E-04   .000E+00  -2.642E-04
  1     14     6.631E+00   8.902E-05  8.100E-04   .000E+00  -2.859E-04
  1     15     6.642E+00   1.434E-04  8.222E-04   3.939E-05 -3.566E-04
```

Figure 5.7b Element displacement history

Pos: Position where displacements are calculated

NOD1: First element end
NOD2: Second element end
MID : Element midspan

5.3.6 Plastic displacements

Element plastic displacements may be printed at specified load steps or for the whole loading history. The plastic displacements are listed for both element ends and for element midspan.

```
*******************************      Load case:   1
*   PLASTIC   DISPLACEMENTS   *      Load step:  15
*******************************      Load level: 6.64

Elem. Pos.   X-displ.   Y-displ.   Z-displ.    X-rot.     Y-rot.     Z-rot.

   3  NOD1  1.814E-05   .000E+00  3.498E-09   .000E+00  3.647E-04   .000E+00
   3  MID    .000E+00   .000E+00   .000E+00   .000E+00   .000E+00   .000E+00
   3  NOD2 -3.845E-05   .000E+00   .000E+00   .000E+00 -7.730E-04   .000E+00

   4  NOD1   .000E+00   .000E+00   .000E+00   .000E+00   .000E+00   .000E+00
   4  MID    .000E+00   .000E+00   .000E+00   .000E+00   .000E+00   .000E+00
   4  NOD2   .000E+00   .000E+00   .000E+00   .000E+00   .000E+00   .000E+00
```

Figure 5.8a Element plastic displacements at load step(s)

```
*****************************************
*    PLASTIC   DISPLACEMENT   HISTORY    *
*****************************************

Load   Load      Load          1           3           6           8
case   step      level       Node 2      Node 1      Node 1      Node 2
                            X-displ.    X-displ.    Y-rot.      Y-rot.

  1      1    1.000E+00    .000E+00    .000E+00    .000E+00    .000E+00
  1      2    2.000E+00    .000E+00    .000E+00    .000E+00    .000E+00
  1      3    3.000E+00    .000E+00    .000E+00    .000E+00    .000E+00
  1      4    4.000E+00    .000E+00    .000E+00    .000E+00    .000E+00
  1      5    5.000E+00    .000E+00    .000E+00    .000E+00    .000E+00
  1      6    5.500E+00    .000E+00    .000E+00    .000E+00    .000E+00
  1      7    5.923E+00    .000E+00    .000E+00    .000E+00    .000E+00
  1      8    6.099E+00    .000E+00    .000E+00   5.659E-04    .000E+00
  1      9    6.489E+00    .000E+00    .000E+00   2.014E-03   1.571E-03
  1     10    6.500E+00   1.871E-06    .000E+00   2.057E-03   1.618E-03
  1     11    6.535E+00   7.649E-06    .000E+00   2.189E-03   1.760E-03
  1     12    6.585E+00   1.708E-05   1.218E-05   2.377E-03   1.969E-03
  1     13    6.609E+00   2.169E-05   1.814E-05   2.469E-03   2.070E-03
  1     14    6.631E+00   2.564E-05   1.814E-05   2.547E-03   2.162E-03
  1     15    6.642E+00   2.564E-05   1.814E-05   2.592E-03   2.207E-03
```

Figure 5.8b Element plastic displacement history

Pos: Position where plastic displacements are calculated

NOD1: First element end
NOD2: Second element end
MID : Element midspan

5.4 PLOT DATA

5.4.1 Layout of Plot Data

Currently, POSTFOS has no graphics. Results for plotting are written to symbolic files, using a format that is easily adapted to most graphics systems. These tables may then be input to general plotting programs. (The format of the plotfile is documented in Appedix C, Plotting.)

The plot data are written to a symbolic file as columns of numbers; from two up to five columns, depending on the number of curves in each plot. The first column contains the X-coordinates of the curves, the remaining columns are the Y-coordinate values.

5.4.2 Load-Displacement Plot

Plot data of load-displacement relations may be generated for any nodal degree of freedom.

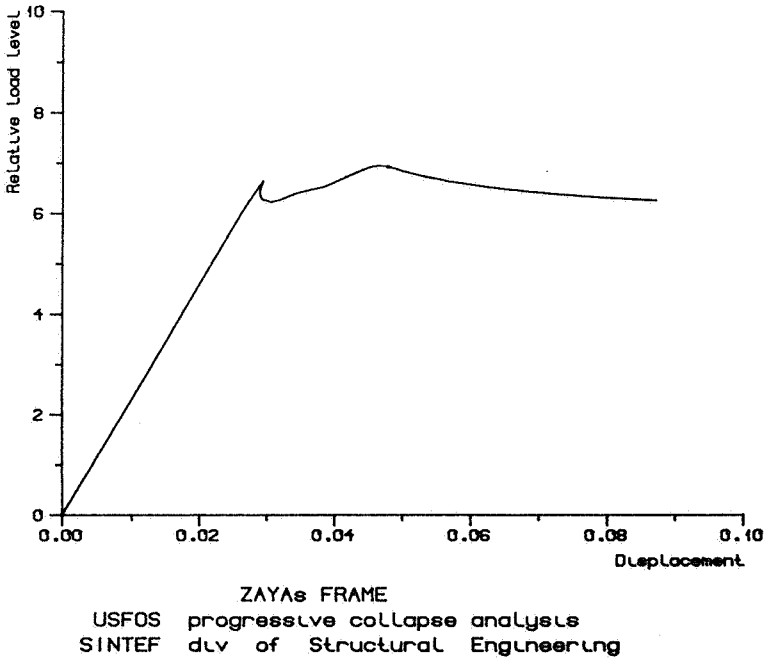


Figure 5.9 Load displacement relationship (USFOS v.3.3)

5.4.3 Energy Absorbtion

The energy absorbtion of the structure may be plotted against load level for each load combination.

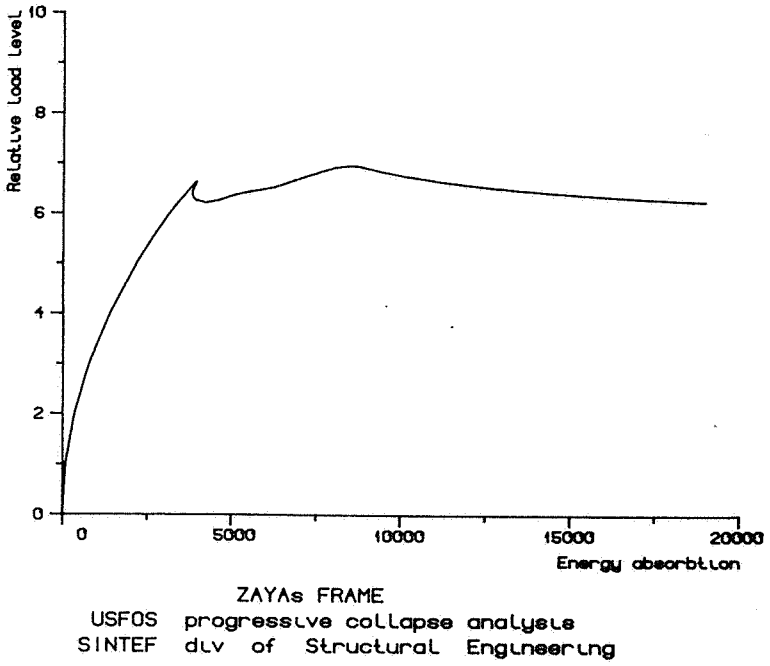


Figure 5.10 Load-energy relationship (USFOS v.3.3)

5.4.4 Element Force Interaction

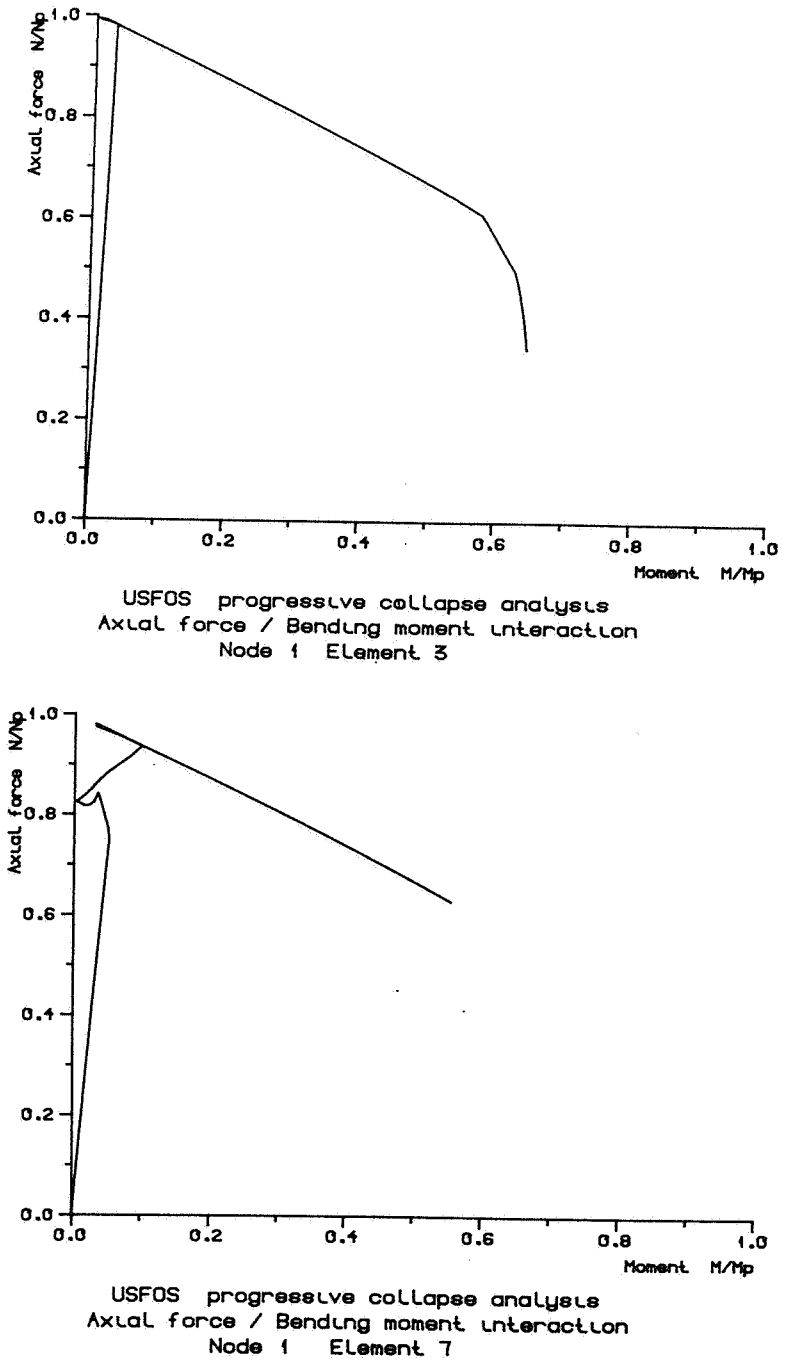


Figure 5.11 Moment-axial force interaction (USFOS v.3.3)

Element 3 = Compression member of upper X-brace
Element 7 = Compression member of lower X-brace

5.4.5 Element Force Histories

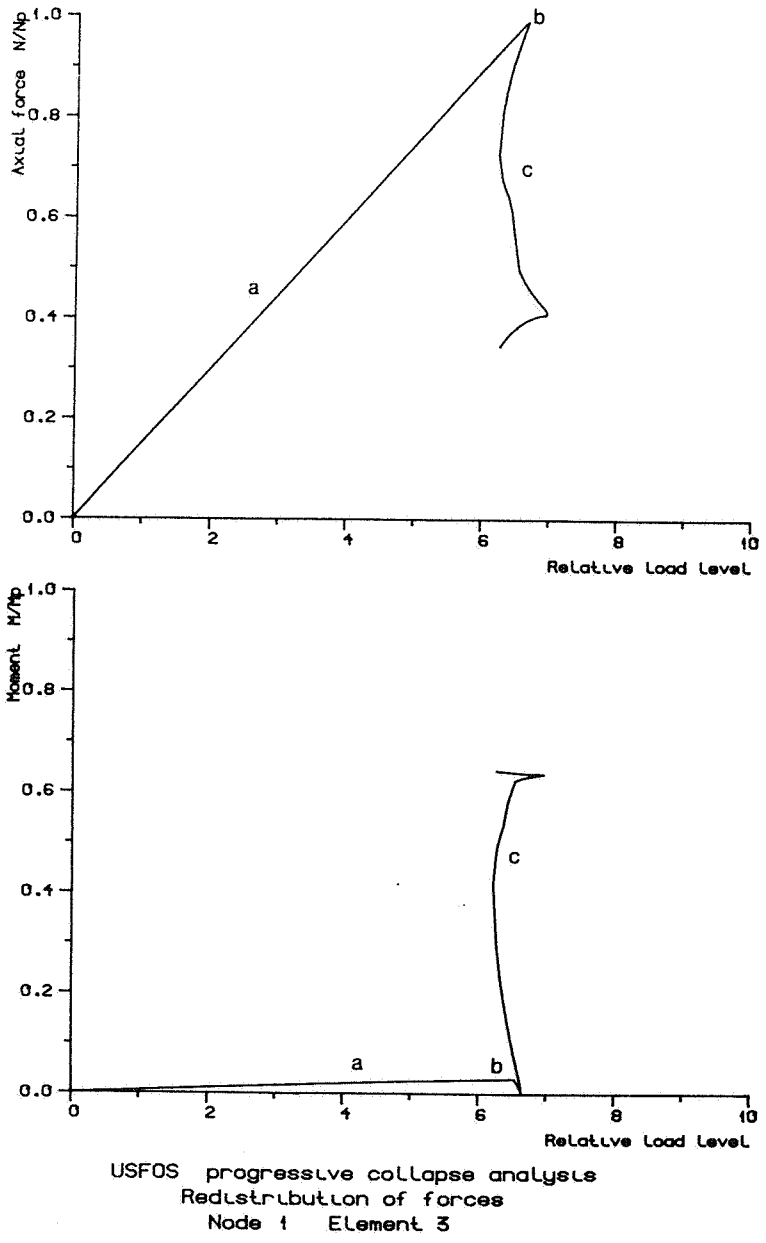


Figure 5.12 Element force vs. load level (USFOS v.3.3)

Element 3 = Compression member of upper X-brace
Element 7 = Compression member of lower X-brace

5.5 DEFORMED GEOMETRY DATA

Deformed geometry files can be created for all load steps where *restart* data is stored. (/2/ Section 4.7)

5.5.1 Layout of Deformed Geometry Data

Currently, POSTFOS has no graphics. Deformed geometry data are written to symbolic files, using a format that is easily adapted to most graphics systems. This data may then be input to FEM plotting programs. (The format of the plotfile is documented in Appedix C, Plotting.)

The deformed geometry file contains the following data :

- Deformed nodal coordinates
- Element connectivity

For ´pin model´ output, plastic hinges are represented as additional nodal points in the structure plot.

Each node is defined by the original, user defined node number. All plastic hinges are represented as additional nodal points. These new ´nodes´ are numbered consecutively, starting at the largest *internal* node number. Then, all ´new´ numbers are increased by 900 000.

Additional elements are introduced between original nodes and plastic hinges etc. These elements are numbered in the same way as the new ´nodes´, starting at the largest internal element number.

If the deformed geometry file contains data from more than one load step, each load step is identified by the following heading :

```
*******************************     Load case: <Lcs>
*  DEFORMED  GEOMETRY  DATA   *     Load step: <Lst>
*******************************
```

5.5.2 Deformed Geometry Plots

Description files of deformed structural geometries may be generated for all load steps. All nodal displacements are scaled by a factor supplied by the user.

Plastic hinges are represented as additional nodal points. Elements in "axial tension failure mode" are not shown. (USFOS v.3.3)

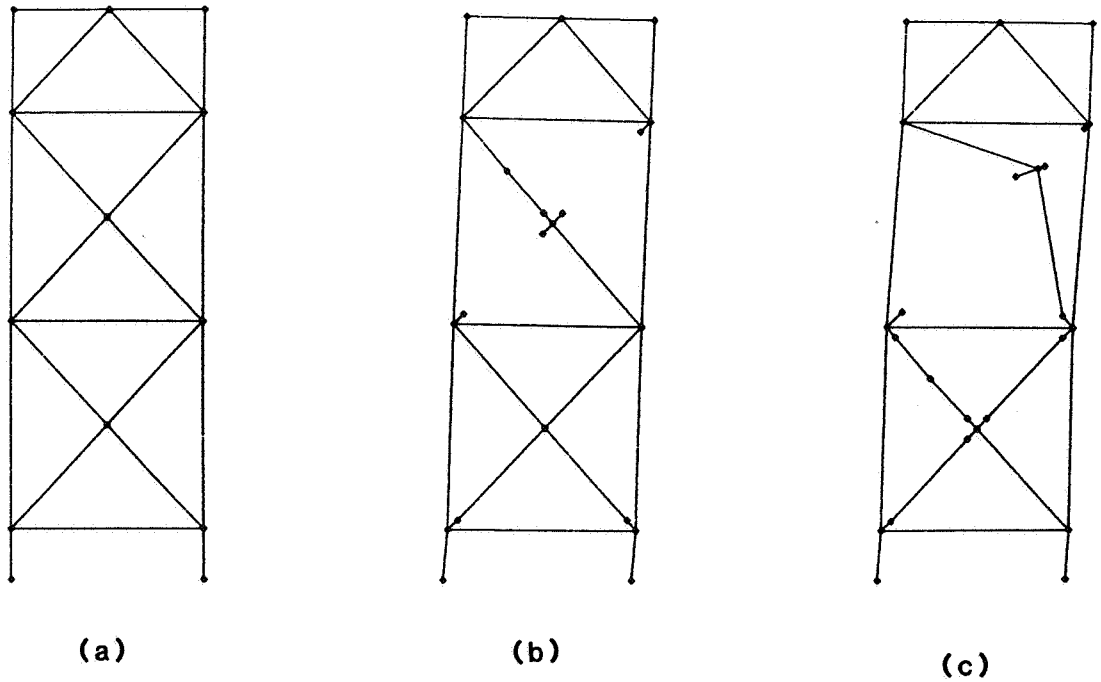


Figure 5.13 Deformed geometry plots (USFOS v.3.3)

a: Initial geometry
b: Prior to ´spring-back´
c: Collapse load level

6 ERRORS AND WARNINGS

Both input data from the user and intermediate results are tested and checked in all parts of the POSTFOS module. This is done to ensure that no further processing takes place based on erroneous data.

If a fatal error occurs during program execution, an error message will be written to the terminal, and the program will leave the control to the user for further action. Less serious errors will be reported back to the user as warnings. For both these error types, an explanatory text will be written together with the standard error message. This text will explain the actual reason for the error situation that has occured.

The standard error messages have one of the following forms:

```
*** ERROR IN RETURN FROM ROUTINE -XXXXXX-, IERR=nn ***
   <Explanatory text>

*** WARNING FROM ROUTINE -XXXXXX-, IERR=nn ***
   <Explanatory text>
```

depending on the error type.

7 DETAILED COMMAND DESCRIPTION

In this chapter a detailed explanation of each available command in POSTFOS is given. Similar information is given if *HELP* is specified for a command.
Only program specific commands are explained. For detailed explanation of the INCA commands see INCA User´s guide, ref /6/.

The description given below is a compiled and edited version of the INCA command file. The abbrevation *n.y.i* given for a command, parameter or option implies that the command, parameter or option is *not yet implemented.*

7.1 FILE HANDLING

- OPEN-FILE

  The purpose of the command is to open specified files.

  Parameters:

  /FILE TYPE/ : Specify file type

  ```
  Options        : U /USFO - The Analysis Result File
                   PR/PRIN - The POSTFOS Print File
                   PL/PLOT - (n.y.i)
                   PT/PTAB - The POSTFOS Plot File
                   GP/GPRE - The Deformed Geometry File(s)

  Default        : USFO
  Maximum length : 4 characters
  ```

  /FILE NAME/ : Give name of file

  ```
  Default        : none
  Maximum length : 60 characters
  ```

- LIST-OPEN-FILES

The purpose of this command is to give a survey of opened files.

Parameters: None

- LIST-FILE-CONTENT

The purpose of this command is to get the survey of the content of a certain file.

Parameters:

/FILE TYPE/ : Specify which file type

Options : U /USFO - The Analysis Result File
PR/PRIN - The POSTFOS Print File
PL/PLOT - (n.y.i)
PT/PTAB - The POSTFOS Plot File

Default : USFO
Maximum length : 4 characters

7.2 PRINT COMMANDS

- DEFINE-HISTORY-TABLE

The purpose of this command is to select data items for the result history table.

Parameters:

/RESULT DATA ITEM / : Specify result data for the history table

Options : GLOBAL

NODAL-FORCE
NODAL-DISPLACEMENT

ELEMENT-FORCE
ELEMENT-DISPLACEMENT
ELEMENT-STRESS
ELEMENT-PLASTIC-DISPLACEMENT
ELEMENT-INTERACTION-VALUE

Default : GLOBAL
Maximum length: 30 characters

The parameter options of the command activates a secondary data specification command :

Option	Secondary command
GLOBAL	SPECIFY-EVENT-PRINT
NODAL-FORCE	SPECIFY-NODE
NODAL-DISPLACEMENT	SPECIFY-NODE
ELEMENT-FORCE	SPECIFY-ELEMENT
ELEMENT-DISPLACEMENT	SPECIFY-ELEMENT
ELEMENT-STRESS	SPECIFY-ELEMENT
ELEMENT-PLASTIC-DISPLACEMENT	SPECIFY-ELEMENT
ELEMENT-INTERACTION-VALUE	SPECIFY-ELEMENT

- DEFINE-STEP-TABLE

The purpose of this command is to select data items for the result step table.

Parameters:

/RESULT DATA ITEM / : Specify result data for the step table

Options : GLOBAL

NODAL-FORCE
NODAL-DISPLACEMENT

ELEMENT-FORCE
ELEMENT-DISPLACEMENT
ELEMENT-STRESS
ELEMENT-PLASTIC-DISPLACEMENT
ELEMENT-INTERACTION-VALUE

Default : GLOBAL
Maximum length: 30 characters

- DEFINE-STRUCTURE-TABLE (n.y.i)

The purpose of this command is to select data items for the structure data table.

Parameters:

/STRUCTURE DATA ITEM / : Specify result data for the structure data table

Options : ALL
ALL-STRUCTURAL-DATA
ALL-LOAD-DATA
ALL-FEM-DATA

ANALYSIS-PARAMETERS
NODAL-POINT-DATA
ELEMENT-DATA
LOCAL-COORDINATE-SYSTEM-DATA
MATERIAL-DATA
CROSS-SECTIONAL-DATA

NODAL-LOADS
ELEMENT-LOADS

FEM-NODAL-DOFS
FEM-ELEMENT-DOFS
FEM-CONNECTIVITY

Default : ALL
Maximum length: 30 characters

- PRINT-HISTORY

The purpose of this command is to print the history table.

Parameters:

/LCS/LST 1/ : Specify first load step of table

Default : First analysis step

/LCS/LST 2/ : Specify last load step of table

Default : Last analysis step

LCS = Load case number
LST = Load step number

Remarks :

The load case number and the load step number are entered consequtively, separated by a slash </>.
The previous *Lcs/Lst* spesifications are stored as new default values.

- PRINT-STEP

The purpose of this command is to print the step table.

Parameters:

/SET NAME/ : Give name of the set to be printed,
see command CREATE-ENTITY-SET

Default : ALL
Maximum length: 4 characters

/LCS/LST/ : Specify load step

LCS = Load case number
LST = Load step number

Default : First analysis step

Remarks :

The load case number and the load step number are entered consequtively, separated by a slash </>.
The previous *Lcs/Lst* spesifications are stored as new default values.

- PRINT-STRUCTURE (n.y.i)

The purpose of this command is to print the structure table.

Parameters:

/SET NAME/ : Give name of the set to be printed,
see command DEFINE-ENTITY-SET

Default : ALL
Maximum length: 4 characters

7.3 MAIN PLOT COMMANDS

- DEFINE-X-AXIS

The purpose of this command is to select data items for the X-axis.

Parameters:

/Plot data item/ : Specify the result data for the X-axis

Options : GLOBAL-LOAD
GLOBAL-DISPLACEMENT
GLOBAL-ENERGY
GLOBAL-STIFFNESS

NODAL-FORCE
NODAL-DISPLACEMENT

ELEMENT-FORCE
ELEMENT-DISPLACEMENT
ELEMENT-STRESS
ELEMENT-PLASTIC-DISPLACEMENT
ELEMENT-INTERACTION-VALUE

Default : GLOBAL-DISPLACEMENT
Maximum length: 30 characters

The parameter options of the command activates a secondary data specification command :

Option	Secondary command
GLOBAL-LOAD	NONE
GLOBAL-DISPLACEMENT	NONE
GLOBAL-ENERGY	NONE
GLOBAL-STIFFNESS	NONE
NODAL-FORCE	SPECIFY-NODE
NODAL-DISPLACEMENT	SPECIFY-NODE
ELEMENT-FORCE	SPECIFY-ELEMENT
ELEMENT-DISPLACEMENT	SPECIFY-ELEMENT
ELEMENT-STRESS	SPECIFY-ELEMENT
ELEMENT-PLASTIC-DISPLACEMENT	SPECIFY-ELEMENT
ELEMENT-INTERACTION-VALUE	SPECIFY-ELEMENT

- DEFINE-Y-AXIS

The purpose of this command is to select data items for the Y-axis.

Parameters:

/Plot data item/ : Specify the result data for the Y-axis

Options : GLOBAL-LOAD
GLOBAL-DISPLACEMENT
GLOBAL-ENERGY
GLOBAL-STIFFNESS

NODAL-FORCE
NODAL-DISPLACEMENT

ELEMENT-FORCE
ELEMENT-DISPLACEMENT
ELEMENT-STRESS
ELEMENT-PLASTIC-DISPLACEMENT
ELEMENT-INTERACTION-VALUE

Default : GLOBAL-DISPLACEMENT
Maximum length: 30 characters

The parameter options of the command activates a secondary data specification command. For NODAL- and ELEMENT- data, the specification request is repeated up to 4 times, that is up to four curves may be generated on one plot.

Option	Secondary command
GLOBAL-LOAD	NONE
GLOBAL-DISPLACEMENT	NONE
GLOBAL-ENERGY	NONE
GLOBAL-STIFFNESS	NONE
NODAL-FORCE	SPECIFY-NODE
NODAL-DISPLACEMENT	SPECIFY-NODE
ELEMENT-FORCE	SPECIFY-ELEMENT
ELEMENT-DISPLACEMENT	SPECIFY-ELEMENT
ELEMENT-STRESS	SPECIFY-ELEMENT
ELEMENT-PLASTIC-DISPLACEMENT	SPECIFY-ELEMENT
ELEMENT-INTERACTION-VALUE	SPECIFY-ELEMENT

- DEFINE-STRUCTURE-PLOT

The purpose of this command is to select output data type and parameters for the structure plot

Parameters:

/Output data/ : Specify the output data type

Options : GLOBAL-DISPLACEMENT
ELEMENT-FORCE
ELEMENT-STRESS
ELEMENT-PLASTIC-DISPLACEMENT
ELEMENT-INTERACTION-VALUE

Default : GLOBAL-DISPLACEMENT
Maximum length: 20 characters

The parameter options of the command activates a secondary data specification command.

Option	Secondary command
GLOBAL-DISPLACEMENT	SPECIFY-SCALING-FACTOR
ELEMENT-FORCE	NONE
ELEMENT-STRESS	NONE
ELEMENT-PLASTIC-DISPLACEMENT	NONE
ELEMENT-INTERACTION-VALUE	NONE

- PRINT-PLOTFILE

The purpose of this command is to print selected plot data to file, in symbolic format.

Parameters:

/LCS/LST 1/ : First load step of plot

Default : First analysis step

/LCS/LST 2/ : Last load step of plot

Default : Last analysis step

LCS = Load case number
LST = Load step number

Remarks :

The load case number and the load step number are entered consequtively, separated by a slash </>.
The previous *Lcs/Lst* spesifications are stored as new default values.

- PRINT-STRUCTURE-PLOT

The purpose of this command is to print structure plot data for selected load steps to file, in symbolic format.

Parameters:

/LCS/LST 1/ : First load step of plot

Default : First analysis step

/LCS/LST 2/ : Last load step of plot

Default : Last analysis step

LCS = Load case number
LST = Load step number

/Format type/ : Format type of the output file

Options : SESAM
PATRAN
MOVIEBOX

Default : SESAM
Maximum length: 8 characters

Remarks :

The load case number and the load step number are entered consequtively, separated by a slash ‹/›.
The previous *Lcs/Lst* spesifications are stored as new default values.

- DRAW (n.y.i)

Use: The purpose of this command is to execute the plot defined by the commands DEFINE-X-AXIS and DEFINE-Y-AXIS

Parameters:

/LCS/LST 1/ : First load step of plot

Default : First analysis step

/LCS/LST 2/ : Last load step of plot

Default : Last analysis step

LCS = Load case number
LST = Load step number

Remarks :

The load case number and the load step number are entered consequtively, separated by a slash </>.
The previous *Lcs/Lst* spesifications are stored as new default values.

- PAGE

Use: The purpose of this command is to clear the screen when wanted.

Parameters:

/BACKGROUND COLOUR/ : Specify the background colour, the following colour codes are available;

0 - Black	1 - White	2 - Red
3 - Green	4 - Blue	5 - Cyan
6 - Magenta	7 - Yellow	

Default : 0
Value range : [0,7]

7.4 ENTITY SET COMMANDS

- CREATE-ENTITY-SET

The purpose of this command is to group data entities (node numbers, element numbers, cross section numbers etc.) into *entity sets*, and assign a logical name to the *set*. The name of the set is used in commands to print analysis results. By referring to this logical name, the specified command is executed for all data entities in the set. The content of one set can be added to, or removed from, other sets.

POSTFOS provides the following pre defined entity sets :

ALL	- Pre-defined set of all entities
ANOD	- Pre-defined set of all node numbers
AMEM	- Pre-defined set of all member numbers
ASEC	- Pre-defined set of all section numbers
AMAT	- Pre-defined set of all material numbers

Parameters :

/SET NAME/ : Give logical name of the set to be created

Default : none
Maximum length : 4 characters

- APPEND-ENTITY-SET

The purpose of this command is to append data entities to an entity set.

Parameters :

/SET NAME/ : Give name of the set to be expanded

Default : none
Maximum length : 4 characters

/ENTITY DEFINITION/ : Specify entity-definition

Options: SING - append single entities
GROU - append a group of entities
SET - append a set of entities

Default : SING
Maximum length : 4 characters

The parameter options of the command activates a secondary data specification command :

Option	Secondary command
SING	SPECIFY-SINGLE-ENTITY
GROU	SPECIFY-ENTITY-GROUP
SET	SPECIFY-SET

- REMOVE-ENTITY-SET

The purpose of this command is to remove data entities from an entity set.

Parameters :

/SET NAME/ : Give name of the set to be contracted

Default : none
Maximum length : 4 characters

/ENTITY DEFINITION/ : Specify entity-definition

Options: SING - remove single entities
GROU - remove a group of entities
SET - remove a set of entities

Default : SING
Maximum length : 4 characters

The parameter options of the command activates a secondary data specification command :

Option	Secondary command
SING	SPECIFY-SINGLE-ENTITY
GROU	SPECIFY-ENTITY-GROUP
SET	SPECIFY-SET

- CLEAR-ENTITY-SET

The purpose of this command is to clear all data entities from an entity set.

Parameters :

/SET NAME/ : Give name of the set to be cleared

Default : none
Maximum length : 4 characters

- LIST-ENTITY-SET

The purpose of this command is to list all data entities in an entity set.
´Blank´ set name gives a list of all defined sets.

Parameters :

/SET NAME/ : Give name of the set to be listed
´Blank´ set name gives a list of all defined sets.

Default : none
Maximum length : 4 characters

- DELETE-ENTITY-SET

The purpose of this command is to delete the set definition

Parameters :

/SET NAME/ : Give name of the set to be deleted

Default : none
Maximum length : 4 characters

7.5 DATA SPESIFICATIONS COMMANDS

- SPECIFY-SINGLE-ENTITY

The purpose of this command is to specify single data entities for the ...-ENTITY-SET commands

The entity specification will be repeated. To terminate the specification, type <!>.

Parameters :

/ENTITY/ : Give entity number
(Node number, element number, cross section number etc.)

Default : 1
Value range : [1/1000000000]

- SPECIFY-ENTITY-GROUP

The purpose of this command is to specify a goup of data entities for the ...-ENTITY-SET commands

All entity numbers, starting from <Entity 1> and incremented by <Increment> up to and including <Entity 2>, are specified for the ...-ENTITY-SET command.

The entity specification will be repeated. To terminate the specification, type <!>.

Parameters :

/ENTITY 1/ : Give first number of entity group
(Node number, element number, cross section number etc.)

Default : 1
Value range : [1/1000000000]

/ENTITY 2/ : Give second number of entity group
(Node number, element number, cross section number etc.)

Default : 1
Value range : [1/1000000000]

/INCREMENT/ : Give increment in entity numbers
(Node number, element number, cross section number etc.)

Default : 1
Value range : [1/1000000000]

- SPECIFY-SET

The purpose of this command is to specify a set of data entities for the ...-ENTITY-SET commands

All entity numbers of the set are specified for the ...-ENTITY-SET command.

The entity specification will be repeated. To terminate the specification, type <!>.

Parameters :

/SET NAME/ : Give name of entity set

Options: <Set name> - User defined set name
ALL - Pre-defined set of all entities
ANOD - Pre-defined set of all node numbers
AMEM - Pre-defined set of all element numbers
ASEC - Pre-defined set of all section numbers
AMAT - Pre-defined set of all material numbers

Default : ALL
Maximun length : 4 characters

- SPECIFY-DATA

The purpose of this command is to specify which data group of the Analysis Result File shall be inspected.

File statistics are listed at the specified load step, for all arrays belonging to the selected data group

The data specification will be repeated. To terminate the specification, type <!>.

Parameters :

/ANALYSIS DATA GROUP/ : Specify data group

Options	:	ST/STRU - Structure data
		RS/RESU - Resut data (stored every step)
		RT/REST - Restart data (stored every n´th step)
Default	:	STRU
Maximun length	:	4 characters

/LOAD STEP/ : Give load step number

Default	:	0
Value range	:	[1/1000000000]

- SPECIFY-NODE

The purpose of this command is to specify node number and global degree of freedom for the plot definition commands (DEFINE-...-AXIS) or for the history-table definition command (DEFINE-HISTORY-TABLE).

The node specification will be repeated according to the page width (see command *SET-PAGE-SIZE*) or the max number of curves per plot.

Print to terminal have 80 characters page width as default, which give room for four columns of node/element results, i.e. the *SPECIFY-NODE* command is repeated four times. Print to file have 132 characters page width, i.e eight-column output or eight node specifications.

Currently, the maximum number of curves per plot is set to four.

To terminate the specification, type <!>.

Parameters :

/NODE/ : Give node number

Default : 1
Value range : [1/1000000000]

/DOF/ : Give global degree of freedom

Options : 1 - global X force / displacement
2 - global Y force / displacement
3 - global Z force / displacement
4 - global X moment / rotation
5 - global Y moment / rotation
6 - global Z moment / rotation

Default : 1
Value range : [1,6]

- SPECIFY-ELEMENT

The purpose of this command is to specify element number, node number and element degree of freedom for the plot definition commands (DEFINE-...-AXIS) or for the history-table definition command (DEFINE-HISTORY-TABLE).

The element specification will be repeated according to the page width (see command *SET-PAGE-SIZE*) or the max number of curves per plot.

Print to terminal have 80 characters page width as default, which give room for four columns of node/element results, i.e. the *SPECIFY-ELEMENT* command is repeated four times. Print to file have 132 characters page width, i.e eight-column output or eight node specifications.

Currently, the maximum number of curves per plot is set to four.

To terminate the specification, type <!>.

Parameters :

/ELEMENT/ : Give element number

Default : 1
Value range : [1/1000000000]

/NODE/ : Give node number

Options : 1 - element node 1
2 - element node 2
3 - element midspan

Default : 1
Value range : [1,3]

/DOF/ : Give local degree of freedom

Options : 1 - local X force / displacement
2 - local Y force / displacement
3 - local Z force / displacement
4 - local X moment / rotation
5 - local Y moment / rotation
6 - local Z moment / rotation

Default : 1
Value range : [1,6]

- SPECIFY-EVENT-PRINT

The purpose of this command is to switch on/off print of element plastification events for the DEFINE-HISTORY-TABLE command.

Parameters :

/ON/OFF/ : Switch on/off print of element plastification

Options : ON - position of each plastic hinge formed or unloaded is listed
OF/OFF - number of plastic hinges dformed / formed or unloaded are listed

Default : ON
Maximum length : 3 characters

- SPECIFY-PRINT-CODE (n.y.i)

The purpose of this command is to specify amount of result print for the ´Global´ option of the DEFINE-STEP-TABLE command.

Parameters :

/IPRINT/ : Specify amount of print

Options : 1 - control node displacements, status of heavily stressed elements
2 - plus status of stressed elements
3 - plus status of all elements
4 - all nodal displacements

Default : 1
Value range : [1,4]

- SPECIFY-SCALING-FACTOR

The purpose of this command is to specify scaling factor for the deformed geometry plot. The scaling factor is only used for the /SESAM/ output format.

Parameters :

/Scaling factor/ : Specify scaling factor

Default : 1
Value range : [1,1000]

7.6 SET-UP COMMANDS

- SET-PAGE-SIZE

The command defines a page by number of lines and number of characters per line to be used when generating the result tables.

Parameters:

/CHARACTERS PER LINE/ : Actual number of characters per line

Default : 80
Value range : [80,132]

/LINES PER PAGE/ : Actual number of lines per page

Default : 60
Value range : [20,60]

- SET-DISPLAY-DEVICE (n.y.i)

The purpose of the command is to initiate the graphic device.

Parameters:

/GRAPHIC DEVICE NAME/ : Graphic device name

Options : All available for GPGS-F
Example : TX14 - Standard graphic terminal, TEKTRONIX-4014
TX43 - Raster graphic terminal, TEKTRONIX-4107/09/15
TDGO - Tandberg graphic terminal
TD22 - Tandberg terminal

Default : TDGO
Maximum length: 4 characters

Remarks : The optional graphic device names are installation dependent.

- SET-REMOTE-DEVICE (n.y.i)

The purpose of this command is to initiate the remote graphic unit, e.g. plotter for a hard copy of high quality.

Parameters:

/GRAPHIC DEVICE NAME/ : Give name of graphic device to be used in abbreviated form, see options below.

Options : All available for GPGS-F
Examples : TX62 - Flat-bed plotter, TEKTRONIX-4662
HP70 - Hewlett-Packard A3/A4 plotter, HP-7550

Default : HP70
Maximum length: 4 characters

/LINE NUMBER/ : Line number to the given remote graphic device

Default : 0, the output will be written to a disc file, see command PLOT-PICTURE for further details
Maximum length: 2 digits

Remarks : The optional graphic device names and line numbers are installation dependent.

- SET-VIEW-PARAMETERS (n.y.i)

The purpose of this command is to specify projection type. This command must be followed by a DRAW- command to have any effect.

Parameters:

/X-COORDINATE/ : Specify X-coordinate of the view point

Default : 1.0

/Y-COORDINATE/ : Specify Yp-coordinate of the view point

Default : -1.0

/FUNCTIONAL-COORDINATE/ : Specify function-coordinate of the view point

Default : 1.0

- SET-GRID-TYPE (n.y.i)

The purpose of this command is to switch between the types of gridding.

Parameters:

/GRID TYPE/ : Specify type of gridding

Options :-1 - Grid intersection crosses
1 - Solid lines
2 - Grid intersection points
3 - Dotted lines
4 - Dashed lines
5 - Dashed-Dotted lines

Default : 1
Value range : [-1,5] except 0

- SET-PICTURE-TITLES (n.y.i)

The purpose of this command is to change the main title for the current picture. The given text string must be surrounded by quotes.

Parameters:

/PICTURE TITLE/ : The new main title the user wants to have for the current picture.

Default : Blank
Maximum length: 80 characters

- SET-AUTO-DISPLAY (n.y.i)

The purpose of this command is to switch on/off automatic display after picture generation.

Parameters:

/AUTO DISPLAY/ : Switch the automatic display on/off.

Options : OF/OFF - Automatic display off
ON - Automatic display on

Default : ON
Maximum length: 3 characters

- LIST-STATUS (n.y.i)

The purpose of this command is to print an overview of the different user controlled program settings currently active.

Parameters:

/TYPE/ : Specify control parameter type

Options : PR/PRIN - Print control
PL/PLOT - Plot (display) control

Default : PLOT
Maximum length: 4 characters

7.7 PICTURE BUFFER HANDLING COMMANDS

- SET-CURRENT-PICTURE (n.y.i)

  By using this command the user may select any of the generated pictures. Every generated picture is uniquely identified by a number. The content of the picture buffer, including the picture identification numbers, may be listed using the command LIST-PICTURE-BUFFER-CONTENT.

  Parameters:

  /PICTURE NUMBER/ : Select one of the defined pictures

  Default : 1
  Value range : [1,32]

- DISPLAY-PICTURE (n.y.i)

  This command must always be used to display the generated picture on the device specified by the command SET-DISPLAY-DEVICE.

  Parameters: None

- PLOT-PICTURE (n.y.i)

  The purpose of this command is to display the generated picture on the remote graphic device specified by the command SET-REMOTE-DEVICE.

  Parameters: None

  By using a disc file as a remote device only one picture is possible to store at a time.

- DELETE-PICTURE (n.y.i)

  The purpose of this command is to delete the current picture from the picture buffer. The current picture is selected by the SET-CURRENT-PICTURE command.

  Parameters: None

- WRITE-PICTURE (n.y.i)

  The purpose of this command is to store the current picture on the POSTFOS plot file. The current picture is selected by the SET-CURRENT-PICTURE command.

  Parameters: None

- READ-PICTURE (n.y.i)

  The purpose of this command is to read generated pictures from the POSTFOS plot file. The content of the plot file may be listed by the LIST-FILE-CONTENT command.

  Parameters:

  /PICTURE NUMBER/ : Select one of the generated pictures available on the file.

  Default : 1
  Value range : [1,512]

- LIST-PICTURE-BUFFER-CONTENT (n.y.i)

  The purpose of this command is to list the content of the picture buffer.

  Parameters: None

- ASSIGN-PICTURE-PARTS (n.y.i)

The purpose of this command is to switch on/off parts of the picture. The changes will remain until new changes are specified.

A picture consists of the following parts:

1 - Frame
2 - Text
3 - Curves inside the frame
4 - Coordinate system
5 - Grid
6 - Additional information (set numbering, marking of points, point numbering etc.)

Parameters:

Options : 0 - off
1 - on

/FRAME/ : Specify if the frame is to be switched on/off

Default : 1
Value range : [0,1]

/TEXT/ : Specify if the text is to be switched on/off

Default : 1
Value range : [0,1]

/MAIN CURVE/ : Specify if the curves are to be switched on/off

Default : 1
Value range : [0,1]

/COORDINATE SYSTEM/ : Specify if the coordinate system is to be switched on/off

Default : 1
Value range : [0,1]

/GRID/ : Specify if the grid is to be switched on/off

Default : 1
Value range : [0,1]

/ADDITIONAL INFORMATION/ : Specify if the additional information is to be switched on/off

Default : 1
Value range : [0,1]

- SELECT-COLOUR (n.y.i)

The purpose of this command is to change colour of parts of the picture. A picture consist of the following parts :

1 - Frame
2 - Text
3 - Curves inside the frame
4 - Coordinate system
5 - Grid
6 - Additional information (set numbering, marking of points, point numbering etc.)

The following colour codes are available :

0 - Black	1 - White	2 - Red
3 - Green	4 - Blue	5 - Cyan
6 - Magenta	7 - Yellow	

Parameters :

/FRAME/ : Specify the colour of the frame

Default : 7
Value range : [0,7]

/TEXT/ : Specify the colour of the text

Default : 6
Value range : [0,7]

/MAIN CURVE/ : Specify the colour of the curves

Default : 2
Value range : [0,7]

/COORDINATE SYSTEM/ : Specify the colour of the coordinate system

Default : 1
Value range : [0,7]

/GRID/ : Specify the colour of the grid

Default : 4
Value range : [0,7]

/ADDITIONAL INFORMATION/ : Specify the colour of the additional information

Default : 2
Value range : [0,7]

7.8 PROGRAM TERMINATION

- EXIT

  The purpose of this command is to terminate the program execution.

  Parameters: None

- QUIT

  The purpose of this command is to terminate the program execution.

  Parameters: None

XFOS

VERSION 1.0

developed by

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TABLE OF CONTENTS:

8.1 INTRODUCTION

The current version of XFOS is an interactive graphical postprocessor which reads the USFOS binary result/model database file, (the RAF-file).

XFOS is an interacive program for presenting USFOS results by use of both 3D graphics (coloured shaded images), and XY-plots. Both the 3D-graphics and the XY-plots may be hardcopied on a Postscript printer, (colour or black-white). (XFOS generates Postscript files which are sent to a Postscript printer).

The pictures presented in this section are screendumps which are printed by a Postscript printer.

XFOS is based on the MOTIF styleguide. For the user, this means that manipulating windows within XFOS will be similar to the user interface of the actual UNIX workstations . (Stretching windows, making icons, restore icons, move windows, select within dialogue boxes, etc. ....).

(See MOTIF Styleguide and MOTIF Userguide for further information).

8.2 SYSTEM REQUIREMENTS

The current implementation of XFOS is based on the following requirements:

Hardware:

- UNIX workstation
- 256 colours (8 bit-planes)
- 19" Screen (A smaller screen will work, but is not recommended)
- At least ca. 15 MIPS CPU
- At least 16 Mbytes internal memory
- Printer (or any other hardcopy unit) with Postscript interface.

For large USFOS models (more than 2 - 300 elements), both CPU with higher performance and larger internal memory than indicated above are recommended in order to avoid excessive response time of the system.

It is recommended to use the CPU´s local disc to avoid heavy network traffic, as this will increase the response time.

Software:

The following software is needed on the UNIX computer.

- X-windows release 4, (X11R4)
- MOTIF version 1.1
- A UNIX version that supports the X-windows and MOTIF version described.
- ANSI C compiler
- FORTRAN-77 compiler

8.3 DESCRIPTION OF USE

8.3.1 Getting Started

The current version of XFOS is a postprocessor that is run subsequent to the USFOS response analyses. XFOS reads the USFOS result/restart file, (files with extension .raf).

Starting XFOS:

- Move to the directory where the actual raf-files are stored.
- Type ´xfos´

The following window shown in Fig 8.1 will appear on the screen and the XFOS module enters an idle state waiting for input. If not, check section 8.4, ´Fault diagnostics´. It is possible to change the size of the window, and it is recommended to use as large XFOS window as possible.

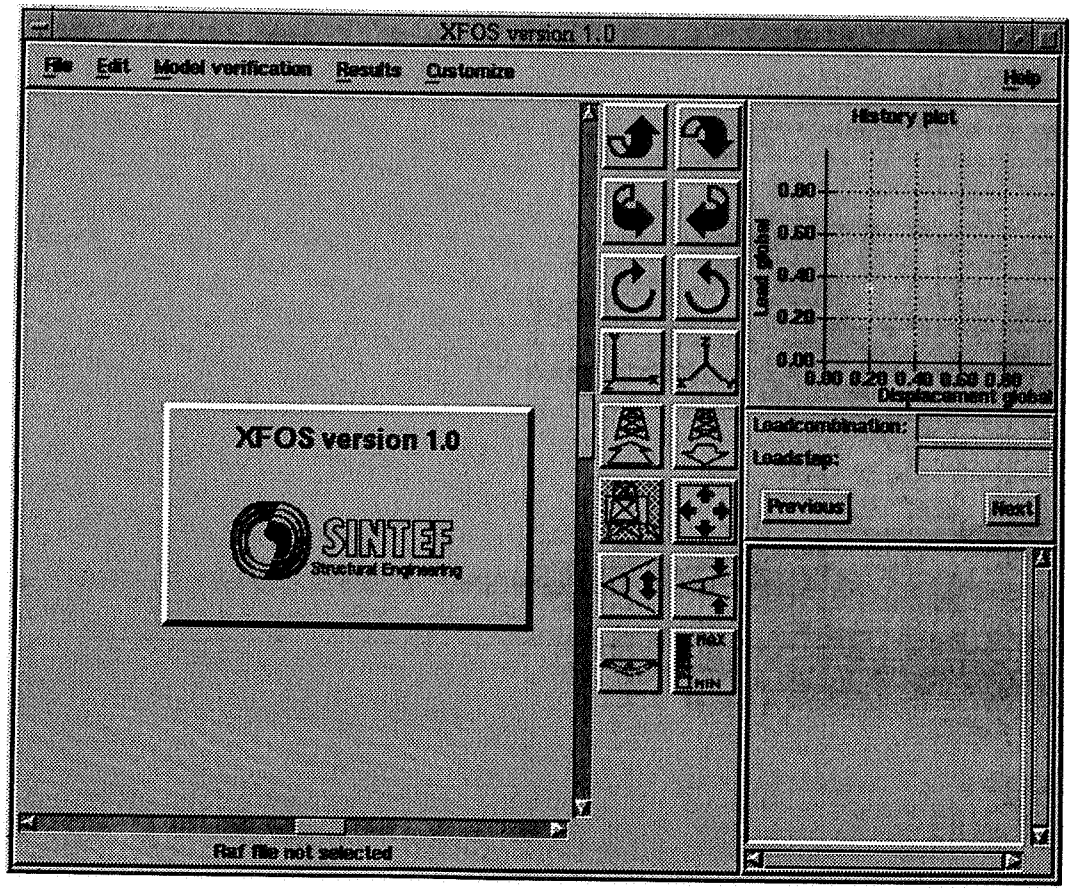


Figure 8.1 XFOS start up window

Open File:

- To open the analysis result file (´raf´-file), press ´File´ , select ´Open´ and release mouse, see figure 8.2.

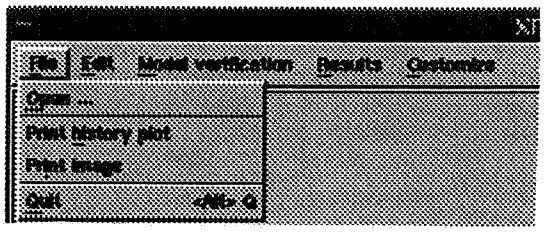


Figure 8.2 The ´File´-dialogue box

- The ´Select new RAF file´ dialogue box appears in the middle of the XFOS window, and point at the actual RAF-file and press ´OK´, see figure 8.3.

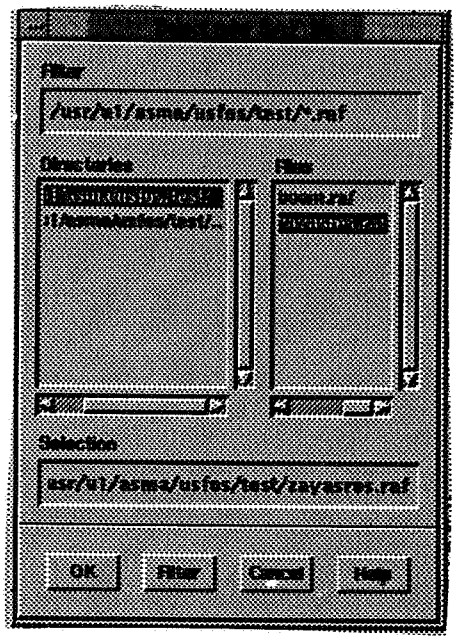


Figure 8.3 The ´Select new RAF file´ dialogue box.

Depending on the model size vs. computer performance, the time required to load the ´raf´-file will vary, (up to 30s). When XFOS is working, the mouse arrow is substituted by a CLOCK icon. When the ´raf´-file is loaded, an image of the structure appears in the ´Image window´, the USFOS heading appears in the ´Text window´ and the ´Global load vs. global displacement´ curve is plotted in the ´History plot window´, see figure 8.4.

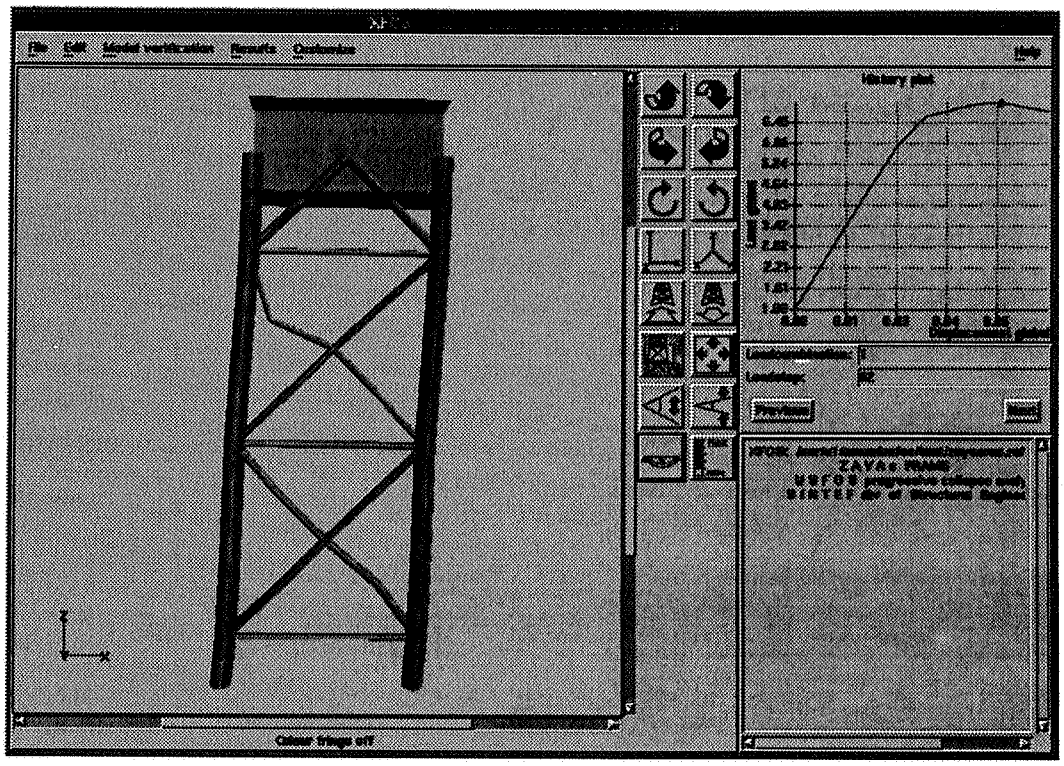


Figure 8.4 XFOS window when ´raf´-file is loaded.

The default result step is step number 1 of the first loadcombination specified on the USFOS input. The point in the XY-plot corresponding to the actual loadcomb/loadstep is marked with a red circle at the curve. There is two different methods to enter which loadstep/loadcomb´s to inspect:

Select Loadstep:

Alternative 1 :

- Point at the curve depicted in the ´History plot window . Press mouse button and drag the arrow along the curve. ´Loadcombination´ and ´Loadstep´ are updated as the mark moves along the curve. Release the mouse-button at the chosen loadstep, and XFOS will load the results from the selected loadstep.

Alternative 2 :

- Push the ´Next´ button to load the next loadstep and ´Previous´ to load the previous loadstep.

The image window will be updated according to the currently selected options, (deformed geometry, fringe, etc...).

Select Analysis Results:

The results are selected as follows:

- Push the ´Result´ button and the ´Result dialogue box´ appears as shown in figure 8.5.

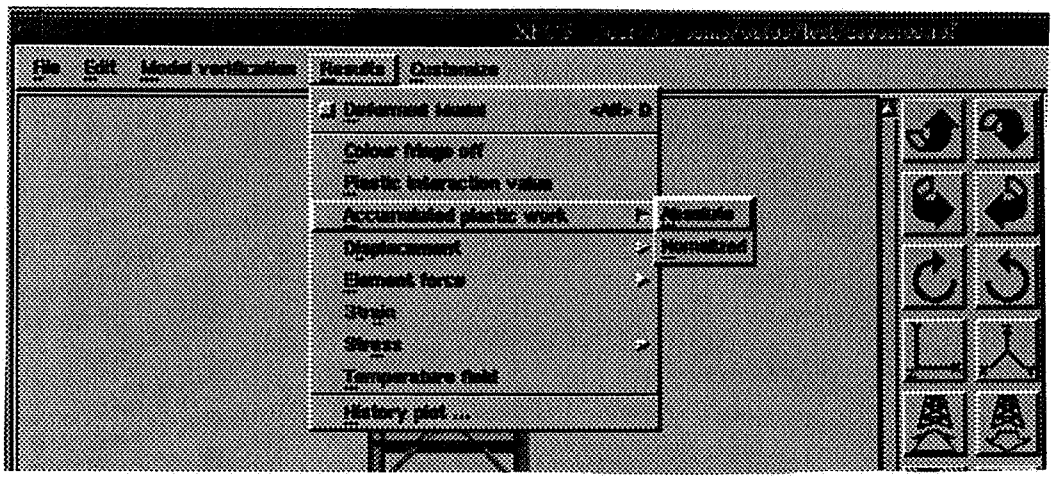


Figure 8.5 The ´Results dialogue box´

- Keep the mouse button depressed and simultaneously move the cursor is to the actual result option and then release the mouse button.

- The response time will vary depending on model size and number of loadsteps contained in the RAF file.

Some restult presentation options also have a sub-menu, ex. ´Accumulated plastic work´ as depicted infigure 8.5. These options have attached the symbol ´>´ at the right hand side.

The ´Deformed model´ button is an on/off switch, with the default value ´off´.

The ´History plot ...´ button is special, and it activates a ´Customize history plot´ window used to define X- and Y- axes in the ´History plot´ window, see figure 8.6.

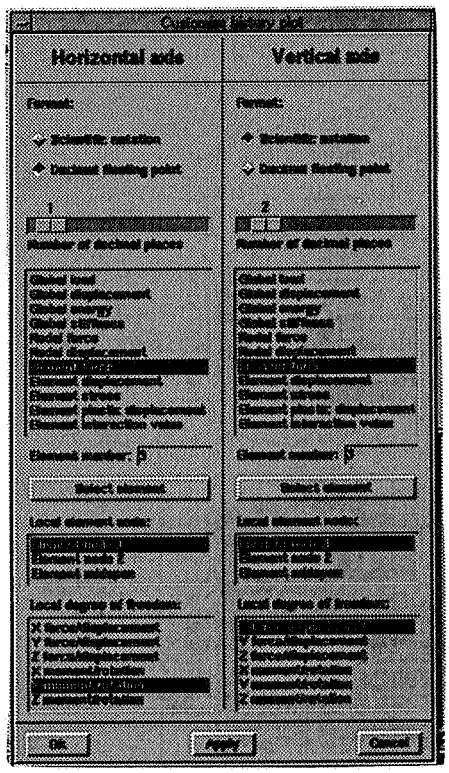


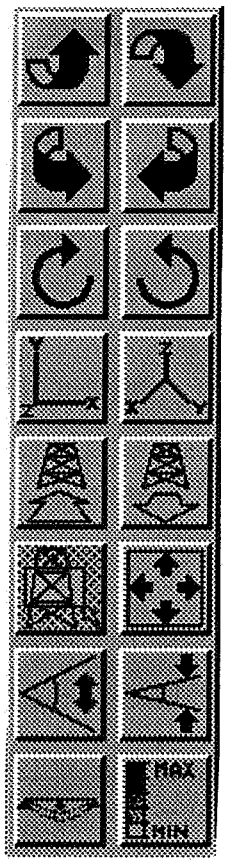
Figure 8.6 The ´Customize history plot´ window for defining X- and Y- axes

When any nodal data is selected, XFOS requires the actual node number.
The nodenumber is defined either by typing the number in the dialogue field, or by pressing ´Select node´ and point/click at the desired joint in the image window. If match, the Node number is updated, and the number is printed on the image of the structure.

Selection and identification of element data / element numbers is done in the same manner. XFOS identifies both element number and local element node, (Node 1, node 2 or midnode).

8.3.2 How to operate the image window

The image of the structure may be manipulated by use of a number of function buttons. Figure 8.7 summarizes the available functions.



Rotate structure about indicated axes.

Rotate structure about indicated axes.

View structure as indicated

View structure as indicated

Zoom out by mouse click

Zoom in by mouse click

Zoom by stretching frame

Restore zoom

Increase perspective

Decrease perspective

Set displacement scalefactor

Set max/min fringe level

Figure 8.7 Image-window function buttons

For all relevant manipulation buttons, the following rule is implemented:

- Mouse button 1 gives MEDIUM reaction
- Mouse button 2 gives MINIMUM reaction
- Mouse button 3 gives MAXIMUM reaction

This is relevant for the rotate-, zoom by click- and perspective-buttons.

The ´Zoom by stretching frame´ button is operated as follows:

- Press mouse button no 1
- Point at upper left corner of the actual frame
- Stretch frame to the lower right corner and release mouse button.

When the ´Set displacement scalefactor´ and ´Set max/min fringe level´ buttons are depressed, dialogue boxes appear, see figure 8.8

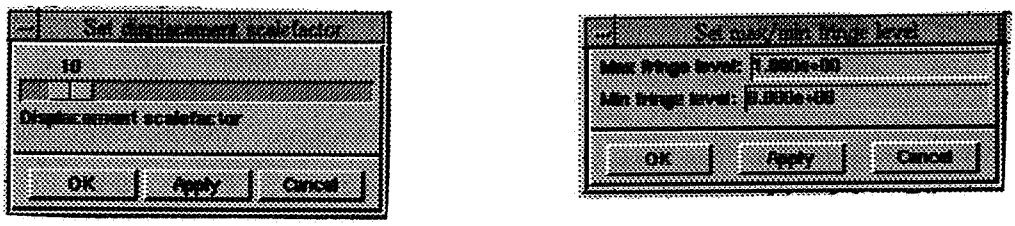


Figure 8.8 Set displacement scalefactor dialogue box

Set max/min fringe level dialogue box

The ´displacement scalefactor´ is set by ´pulling´ the scrollbar.
The ´fringe levels´ are typed into the dialogue fields, (The dialogue fields are activated by point/click).

The ´OK´ button will update the image and close the dialogue box, (keeping new modified values).
The ´Apply´ button will update the image only and still keep the dialogue open.
The ´Cancel´ button will close the dialogue box and values are unchanged, (previous values are kept).

Moving the structure in the screen plane, (pan), is preformed by mouse button 2. This option works as follows:

- Point in the image window
- Press mouse button no. 2
- Move the mouse-arrow in the direction/length you want the structure to move.
- Release the mouse, and the structure moves accordingly in the screen plane.

8.3.3 Results

The available result ´buttons´ are described in detailin the following :

Button	Description
Deformed Model	On/off switch, deformed model. By default the switch is off.
Colour fringe off	Remove colour fringe and present a shaded image of the structure. Default on.
Plastic interaction value	Superimpose the ´plastic interaction values´ on the entire image of the structure using colour fringes to describe the different values. (This is the ´gamma-value´ in USFOS + 1.0). This option gives an indication of utilization at the end- and midnodes of the individual structural members.
Accumulated plastic work	Present the accumulated plastic work on the entire structure. Absolute and normalized values are avaliable. This option indicates in which regions the structure absorb energy, absolutely or relatively.
Displacements	Present the different displacement components by use of colour fringe.
Element forces	Present element force component by use of colour fringe. Absolute and normalized forces are avaliable.
Stress	Present element stress component by use of colour fringe. Axial stress, shear stress and effective stress are available.
Temperature field	Present the element temperature load level at the current loadstep.

8.3.4 Overview of available ´commands´

Main button	Sub button	Brief description of function
File	Open	Open new RAF-file
"	Print history plot	XY-plot -> Postscript plot
"	Print image	Image -> Postscript plot
"	Quit	Terminate XFOS
Edit	....	Not used
Model Verification	....	Not used
Results	Deformed Model	On/off switch, deformed model
"	Colour fringe off	Switch to shaded image mode
"	Plastic interaction value	Fringe interaction values
"	Accumulated plastic work	Fringe acc. plastic work
"	Displacements	Fringe displacement components
"	Element forces	Fringe element force components
"	Strain	Not used
"	Stress	Fringe element stress comp.
"	Temperature field	Fringe actual temp. field
"	History plot	Switch to ´Customize history plot´
Customize	Window	Set relative size between XY-plot and image window
Help	....	Not used

8.4 FAULT DIAGNOSTICS

Symptoms / messages	Possible solution/explanation
XFOS fails to start and the following message is printed: ´Can´t open $DISPLAY´	The environmental variable DISPLAY is either undefined or is defined to a screen which the user don´t have access to.
XFOS starts, but there is no pixture of the structure in the 3D image window.	Reduce the prerspective by pushing the prespective button a few times.
Structure is ´lost´ from the 3D image window during ZOOM	Push the restore button. If this does not work, terminate XFOS and start up again.
No global displacement / global load plot in the XY-plot window	USFOS is run without result saving, (CSAVE 0 0).

APPENDIX A - POSTFOS COMMAND STRUCTURE

A.1 PRINT COMMANDS

Command Number	Command	Parameter otions	Activates secondary command	Repetition of second. command
		Global	SPECIFY-EVENT-PRINT	NO
		Nodal-Force	SPECIFY-NODE	4/8
		Nodal-Displacement	SPECIFY-NODE	4/8
		Element-Force	SPECIFY-ELEMENT	4/8
35	DEFINE-HISTORY-TABLE	Element-Displacement	SPECIFY-ELEMENT	4/8
		Element-Stress	SPECIFY-ELEMENT	4/8
		Element-Plastic-Displacement	SPECIFY-ELEMENT	4/8
		Element-Interaction-Value	SPECIFY-ELEMENT	4/8
		Global	SPECIFY-PRINT-CODE	NO
		Nodal-Force	- none -	-
		Nodal-Displacement	- none -	-
36	DEFINE-STEP-TABLE	Element-Force	- none -	-
		Element-Displacement	- none -	-
		Element-Stress	- none -	-
		Element-Plastic-Displacement	- none -	-
		Element-Interaction-Value	- none -	-

Command Number	Command	Parameter otions	Activates secondary command	Repetition of second. command
		All	- none -	-
		All-Structural-Data	- none -	-
		All-Load-Data	- none -	-
		All-FEM-Data	- none -	-
		Analysis-Parameters	- none -	-
		Nodal-Point-Data	- none -	-
		Element-Data	- none -	-
37	DEFINE-STRUCTURE-TABLE	Local-Coordinate-System-Data	- none -	-
		Material-Data	- none -	-
		Cross-Secional-Data	- none -	-
		Nodal-Loads	- none -	-
		Element-Loads	- none -	-
		FEM-Nodal-DOFs	- none -	-
		FEM-Element-DOFs	- none -	-
		FEM-Connectivity	- none -	-
38	PRINT-HISTORY	<Lcs/Lst 1> <Lcs/Lst 2>	-	-
39	PRINT-STEP	<Set name> <Lcs/Lst>	-	-
40	PRINT-STRUCTURE	<Set name>	-	-

A.2 PLOT COMMANDS

Command Number	Command	Parameter options	Activates secondary command	Repetition of second. command
		Global-Load	- none -	-
		Global-Displacement	- none -	-
		Global-Energy	- none -	-
		Global-Stiffness	- none -	-
		Nodal-Force	SPECIFY-NODE	4
41	DEFINE-X-AXIS	Nodal-Displacement	SPECIFY-NODE	4
		Element-Force	SPECIFY-ELEMENT	4
		Element-Displacement	SPECIFY-ELEMENT	4
		Element-Stress	SPECIFY-ELEMENT	4
		Element-Plastic-Displacement	SPECIFY-ELEMENT	4
		Element-Interaction-Value	SPECIFY-ELEMENT	4
		Global-Load	- none -	-
		Global-Displacement	- none -	-
		Global-Energy	- none -	-
		Global-Stiffness	- none -	-
		Nodal-Force	SPECIFY-NODE	4
42	DEFINE-Y-AXIS	Nodal-Displacement	SPECIFY-NODE	4
		Element-Force	SPECIFY-ELEMENT	4
		Element-Displacement	SPECIFY-ELEMENT	4
		Element-Stress	SPECIFY-ELEMENT	4
		Element-Plastic-Displacement	SPECIFY-ELEMENT	4
		Element-Interaction-Value	SPECIFY-ELEMENT	4

Command Number	Command	Parameter otions	Activates secondary command	Repetition of second. command
		Global-Displacement	SPECIFY-SCALING-FACTOR	NO
		Element-Force	- none -	-
43	DEFINE-STRUCTURE-PLOT	Element-Stress	- none -	-
		Element-Plastic-Displacement	- none -	-
		Element-Interaction-Value	- none -	-
44	PRINT-PLOTFILE	<Lcs/Lst 1> <Lcs/Lst 2>	-	-
45	PRINT-STRUCTURE-PLOT	<Lcs/Lst 1> <Lcs/Lst 2> <Factor>	-	-
46	DRAW			
47	PAGE			

A.3 ENTITY SET COMMANDS

Command Number	Command	Parameters	Options	Activates secondary command	Repetition of second. command
30	CREATE-ENTITY-SET	<Set name>		- none -	-
31	APPEND-ENTITY-SET	<Set name>	SINGLE	SPECIFY-SINGLE-ENTITY	YES
			GROUP	SPECIFY-ENTITY-GROUP	YES
			SET	SPECIFY-SET	YES
32	REMOVE-ENTITY-SET	<Set name>	SINGLE	SPECIFY-SINGLE-ENTITY	YES
			GROUP	SPECIFY-ENTITY-GROUP	YES
			SET	SPECIFY-SET	YES
33	CLEAR-ENTITY-SET	<Set name>		- none -	-
34	LIST-ENTITY-SET	<Set name>		- none -	-

A.4 DATA SPECIFICATION COMMANDS

Command Number	Command	Parameters	Activates secondary command	Repetition of second. command
21	SPECIFY-SINGLE-ENTITY	<Entity>	-	-
22	SPECIFY-ENTITY-GROUP	<Entity 1> <Entity 2> <Increment>	-	-
23	SPECIFY-SET	<Set name>	-	-
24	SPECIFY-DATA	<Data group>	-	-
25	SPECIFY-NODE	<Node> <DOF>	-	-
26	SPECIFY-ELEMENT	<Element> <Node> <DOF>	-	-
27	SPECIFY-EVENT-PRINT	<ON/OFF>	-	-
28	SPECIFY-PRINT-CODE	<Iprint>	-	-
29	SPECIFY-SCALING-FACTOR	<Factor>	-	-

APPENDIX B - EXAMPLE OF USE

B.1 SELECTED EXAMPLE

To demonstrate the basic features of POSTFOS, this appendix will present postprocessing of analysis results for a two-story, X-braced plane frame structure. This frame is also used as example in the User´s manual /2/,/5/.

The geometry and finite element model is presented in Figure 11.3.

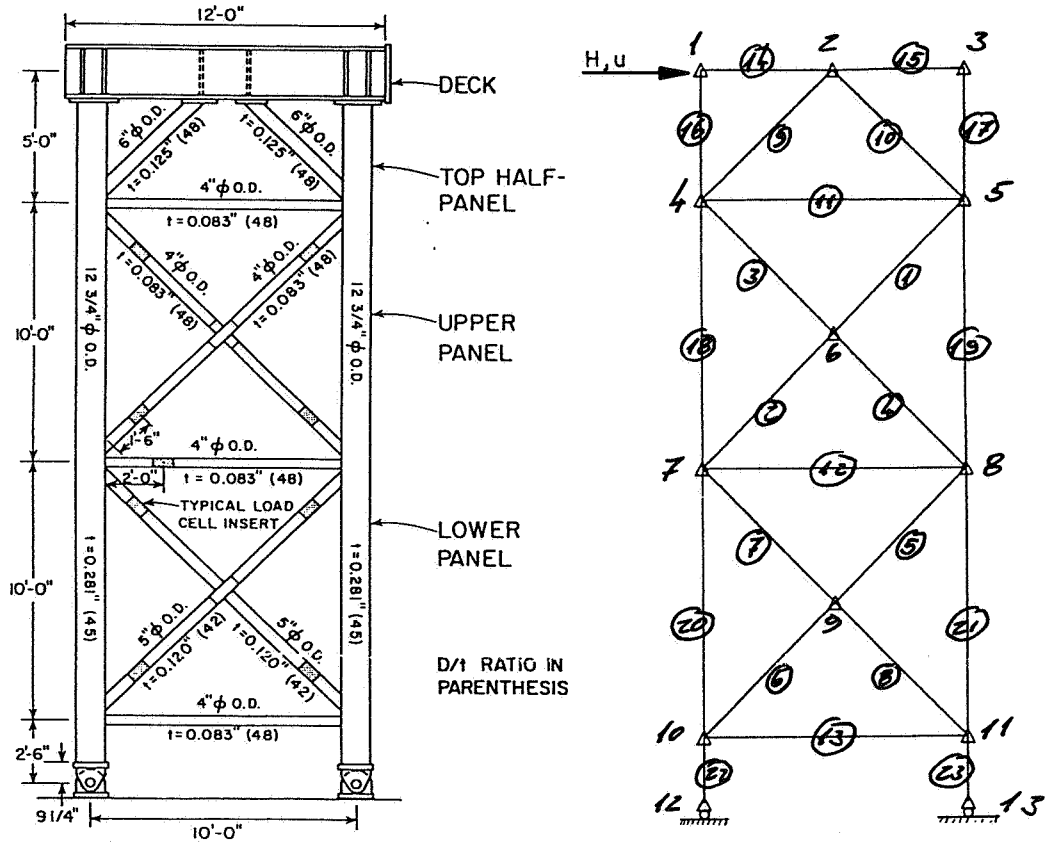


Figure B.1 Plane frame structure

Yield stress, braces σ_y = 248 MPa
, legs σ_y = 324 MPa
, I-beam σ_y = 324 MPa

Initial load H_0 = 40 kN

B.2 EXAMPLE USE OF POSTFOS

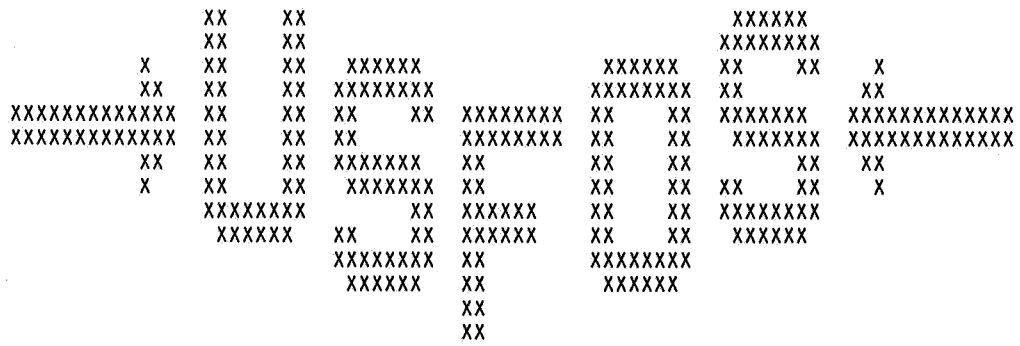
In the following example, user input is underlined.

B.2.1 Initial procedure

When the program is started, POSTFOS prompts for a file name containing analysis result data, i.e the Analysis Result File generated by USFOS.

Example:

```
@ND POSTFOS                ! Starting the program
```



```
                P R E S E N T A T I O N       M O D U L E

                   SINTEF div of Structural Engineering

                   Version 1.0  /  Release   1989-07-12
                   Initiated at   17:22:03   1989-09-30

Postfos:OPEN-FILE
FILE TYPE ..... / USFO / :
FILE NAME ..... / / : ZAYAS

    Opening of (USFOS-TEST)ZAYAS in progress
    Opening succeeded

    Reading resident data in progress
    Reading succeeded

    Opening of (PACK-TWO-2:USFOS-TEST)ZAYAS:PRI in progress
    Opening succeeded

    Opening of (PACK-TWO-2:USFOS-TEST)ZAYAS:PLO in progress
    Opening succeeded

Postfos:
```

POSTFOS opens one print file and one plotfile with default filenames and filetype. Default filename is the name of the Analysis Result File. Default filetypes are *´PRI´* and *´PLO´* for the print and plot file, respectively.

```
Postfos:LIST-OPEN-FILES

USFOS analysis File ..... (PACK-TWO-2:USFOS-TEST)ZAYAS:RAF;1
Print File .............. (PACK-TWO-2:USFOS-TEST)ZAYAS:PRI;1
Plot File, GPGS dependent .... NOT CONNECTED
Plotfile, symbolic format .... (PACK-TWO-2:USFOS-TEST)ZAYAS:PLO;1

Postfos:
```

The output may be directed to terminal or to other files by the OPEN-FILE command :

```
Postfos:OPEN-FILE
FILE TYPE ........... / USFO / : PRIN
FILE NAME ........... / / : TERM

    Opening of TERM in progress
    Opening succeeded

Postfos:LIST-OPEN-FILES

USFOS analysis File ..... (PACK-TWO-2:USFOS-TEST)ZAYAS:RAF;1
Print File .............. TERMINAL
Plot File, GPGS dependent .... NOT CONNECTED
Plotfile, symbolic format .... (PACK-TWO-2:USFOS-TEST)ZAYAS:PLO;1

Postfos:
```

B.2.2 HELP feature

POSTFOS has extensive HELP functions implemented, trough the INCA command processor.

Typing *HELP <command>* gives a list of all commands matching the <command> specification. A detailed description of the command will be written if the <command> specification is unambigious. Typing <?> for a parameter gives a detailed description of the parameter, with options, defaults or value range.

```
Postfos:HELP
COMMAND / / : DEFINE

INCA: DEFINE-MACRO
PROG: DEFINE-HISTORY-TABLE
      DEFINE-STEP-TABLE
      DEFINE-STRUCTURE-TABLE
      DEFINE-X-AXIS
      DEFINE-Y-AXIS

Postfos:HELP DEFINE-HISTORY-TABLE

PROG: DEFINE-HISTORY-TABLE
                              ... <Result data item>

... Select data items for result history table

    <Result data item>        ...  Global

                                   Nodal-Force
                                   Nodal-Displacement

                                   Element-Force
                                   Element-Displacement
                                   Element-Stress
                                   Element-Plastic-Displacement
                                   Element-Interaction-Value

Postfos:DEFINE-HISTORY-TABLE GLOBAL
Postfos:SPECIFY-EVENT-PRINT
<ON/OFF> ..... / ON / : ?

... Switch on/off print of element plastification

    Options: ON  - position of each plastic hinge
                   formed or unloaded is listed
             OFF - number of plastic hinges formed / unloaded
                   are listed

     USER TYPE     :  NAME
     DEFAULT VALUE :  ON
     VALID ENTRIES :  ON  / OF  / OFF /

<ON/OFF> ..... / ON / : ON

Postfos:
```

The *DEFINE-HISTORY-TABLE* command activates secondary data specification commands to prompt for extra parameters, e.g. *SPECIFY-EVENT-PRINT*.

B.2.3 Global history output

```
Postfos:HELP PRINT-HISTORY

PROG: PRINT-HISTORY
                              ... <Lcs/Lst 1> <Lcs/Lst 2>

... Print history table

    <Lcs/Lst 1>               ...  First load step of table
                                   (Default = First step)

    <Lcs/Lst 2>               ...  Second load step of table
                                   (Default = Last step)


    Lcs = Load case number
    Lst = Load step number

    The load case number and the load step number are
    entered consequtively, separated by a slash </>.

    The previous Lcs/Lst spesifications are stored as new default values.

Postfos:PRINT-HISTORY
<LCS/LST 1> ......... /      0 / : 1/1
<LCS/LST 2> ......... /      0 / : 1/13



    ****************************************
    *        GLOBAL   LOAD   HISTORY       *
    ****************************************

  Load   Load     Load    Current    Control     Energy      Elem.  Event  Node
  comb.  step     level    stiff.     displ.     absorb.      no.   type    no.

    1      1      1.000    1.000   4.380E-03   8.760E+01
    1      2      2.000    1.000   8.760E-03   3.504E+02
    1      3      3.000    1.000   1.314E-02   7.885E+02
    1      4      4.000    1.000   1.752E-02   1.402E+03
    1      5      5.000    1.000   2.190E-02   2.190E+03
    1      6      5.500    1.000   2.409E-02   2.650E+03
    1      7      5.923    1.000   2.595E-02   3.074E+03
                                                          6   PLAS   NOD1
    1      8      6.099     .948   2.676E-02   3.270E+03
                                                          8   PLAS   NOD2

 <CR>:

  Load   Load     Load    Current    Control     Energy      Elem.  Event  Node
  comb.  step     level    stiff.     displ.     absorb.      no.   type    no.

    1      9      6.489     .887   2.869E-02   3.754E+03
                                                          1   PLAS   NOD2
    1     10      6.500     .865   2.874E-02   3.769E+03
    1     11      6.535     .865   2.892E-02   3.815E+03
                                                          3   PLAS   NOD1
    1     12      6.585     .837   2.918E-02   3.884E+03
    1     13      6.609     .836   2.931E-02   3.917E+03
                                                          3   PLAS    MID
Postfos:
```

When writing to terminal, POSTFOS stops the output when the screen is full. Typing *<CR>* resumes the printing.

B.2.4 Nodal-/element result histories

The *DEFINE-HISTORY-TABLE* command activates secondary data specification commands to prompt for extra parameters. The *SPECIFY-ELEMENT* or the *SPECIFY-NODE* commands are repeated according to the page-size of the output device.
To terminate the data specification, type <!>.

Also note that the previous *Lcs/Lst* specifications are used as new default values for the *PRINT-HISTORY* command.

```
Postfos:DEFINE-HISTORY-TABLE
RESULT DATA ITEM .... / GLOB / : ELEMENT-FORCE
Postfos:SPECIFY-ELEMENT
ELEMENT ............. /      1 / : 1
NODE ................ /      1 / : 3
DOF ................. /      1 / : 1
Postfos:SPECIFY-ELEMENT
ELEMENT ............. /      1 / : 2
NODE ................ /      1 / : 3
DOF ................. /      1 / : 1
Postfos:SPECIFY-ELEMENT
ELEMENT ............. /      1 / : 3 3 1
Postfos:SPECIFY-ELEMENT
ELEMENT ............. /      1 / : 4 3 1
Postfos:PRINT-HISTORY,,,
```

```
    ****************************************
    *     ELEMENT   FORCE   HISTORY        *
    ****************************************

    Load    Load       Load          1           2           3           4
    case    step       level       Midspan     Midspan     Midspan     Midspan
                                   X-force     X-force     X-force     X-force

      1       1     1.000E+00   2.449E+04   2.447E+04  -2.449E+04  -2.448E+04
      1       2     2.000E+00   4.897E+04   4.893E+04  -4.900E+04  -4.896E+04
      1       3     3.000E+00   7.344E+04   7.338E+04  -7.351E+04  -7.346E+04
      1       4     4.000E+00   9.790E+04   9.782E+04  -9.803E+04  -9.798E+04
      1       5     5.000E+00   1.224E+05   1.222E+05  -1.226E+05  -1.225E+05
      1       6     5.500E+00   1.346E+05   1.345E+05  -1.348E+05  -1.348E+05
      1       7     5.923E+00   1.449E+05   1.448E+05  -1.452E+05  -1.452E+05
      1       8     6.099E+00   1.493E+05   1.492E+05  -1.494E+05  -1.494E+05
      1       9     6.489E+00   1.589E+05   1.587E+05  -1.590E+05  -1.590E+05

 <CR>:

    Load    Load       Load          1           2           3           4
    case    step       level       Midspan     Midspan     Midspan     Midspan
                                   X-force     X-force     X-force     X-force

      1      10     6.500E+00   1.591E+05   1.590E+05  -1.593E+05  -1.593E+05
      1      11     6.535E+00   1.599E+05   1.597E+05  -1.602E+05  -1.602E+05
      1      12     6.585E+00   1.610E+05   1.609E+05  -1.614E+05  -1.614E+05
      1      13     6.609E+00   1.616E+05   1.615E+05  -1.619E+05  -1.619E+05
Postfos:
```

B.2.5 Enitity set manipulation

The entity sets are used in commands to print load step results. The specified print command is executed for all data entities in the set.

```
Postfos:LIST-ENTITY-SET
SET NAME ..... / / :

    Set name    No. of Entities
      ALL              23
      ANOD             13
      AMEM             23
      ASEC              2
      AMAT              1

Postfos:LIST-ENTITY-SET ANOD

     Set :  ANOD

         1      2      3      4      5      6      7      8      9     10
        11     12     13

Postfos:CREATE-ENTITY-SET TEST
Postfos:APPEND-ENTITY-SET TEST SET
Postfos:SPECIFY-SET
SET NAME ..... / ALL / : ANOD
Postfos:SPECIFY-SET
SET NAME ..... / ALL / : !
Postfos:LIST-ENTITY-SET TEST

    Set :  TEST

         1      2      3      4      5      6      7      8      9     10
        11     12     13

Postfos:REMOVE-ENTITY-SET TEST GROU
Postfos:SPECIFY-ENTITY-GROUP
ENTITY 1 ..... /      1 / : 1 13 2
Postfos:SPECIFY-ENTITY-GROUP
ENTITY 1 ..... /      1 / : !
Postfos:LIST-ENTITY-SET TEST

    Set :  TEST

         2      4      6      8     10     12

Postfos:APPEND-ENTITY-SET TEST SING
Postfos:SPECIFY-SINGLE-ENTITY
ENTITY ..... /      1 / : 3
Postfos:SPECIFY-SINGLE-ENTITY
ENTITY ..... /      1 / : 5
Postfos:SPECIFY-SINGLE-ENTITY
ENTITY ..... /      1 / : !
Postfos:LIST-ENTITY-SET TEST

    Set :  TEST

         2      3      4      5      6      8     10     12

Postfos:
```

The *APPEND-/REMOVE-* commands activate secondary data specification commands to prompt for extra parameters. The *SPECIFY-* commands are repeated until terminated by typing <!>.

B.2.6 Nodal / element load step results

```
Postfos:DEFINE-STEP-TABLE
RESULT DATA ITEM .... / GLOB / : NODAL-DISPLACEMENT
Postfos:PRINT-STEP
SET NAME ............ / ALL / : TEST
<LCS/LST> ........... /      0 / : 1/10
```

```
    ******************************      Load case:   1
    *   NODAL   DISPLACEMENTS    *      Load step:  10
    ******************************      Load level: 6.50

    Node   X-displ.    Y-displ.    Z-displ.     X-rot.      Y-rot.      Z-rot.

      2   2.873E-02    .000E+00  -5.585E-05    .000E+00   1.325E-03    .000E+00
      3   2.873E-02    .000E+00  -2.065E-03    .000E+00   1.327E-03    .000E+00
      4   2.506E-02    .000E+00   1.937E-03    .000E+00   3.244E-03    .000E+00
      5   2.506E-02    .000E+00  -2.041E-03    .000E+00   3.247E-03    .000E+00
      6   1.957E-02    .000E+00  -4.673E-05    .000E+00   2.106E-03    .000E+00
      8   1.460E-02    .000E+00  -1.504E-03    .000E+00   2.034E-03    .000E+00
     10   6.624E-03    .000E+00   3.406E-04    .000E+00   6.890E-03    .000E+00
     12    .000E+00    .000E+00    .000E+00    .000E+00   8.908E-03    .000E+00
```

```
Postfos:PRINT-STEP TEST 1/20
```

```
    ******************************      Load case:   1
    *   NODAL   DISPLACEMENTS    *      Load step:  20
    ******************************      Load level: 6.47

    Node   X-displ.    Y-displ.    Z-displ.     X-rot.      Y-rot.      Z-rot.

      2   2.907E-02    .000E+00  -6.056E-05    .000E+00   1.318E-03    .000E+00
      3   2.907E-02    .000E+00  -2.061E-03    .000E+00   1.320E-03    .000E+00
      4   2.542E-02    .000E+00   1.920E-03    .000E+00   3.267E-03    .000E+00
      5   2.538E-02    .000E+00  -2.039E-03    .000E+00   3.308E-03    .000E+00
      6   2.503E-02    .000E+00   5.436E-03    .000E+00   4.553E-03    .000E+00
      8   1.457E-02    .000E+00  -1.495E-03    .000E+00   2.116E-03    .000E+00
     10   6.598E-03    .000E+00   3.391E-04    .000E+00   6.870E-03    .000E+00
     12    .000E+00    .000E+00    .000E+00    .000E+00   8.871E-03    .000E+00
```

```
Postfos:
```

B.2.7 Plot data for element histories

```
Postfos:DEFINE-X-AXIS
PLOT DATA ITEM ..... / GLOB-DISP / : ?

... Specify result data for X-axis of plot

    Options: Global-Load
             Global-Displacement
             Global-Energy
             Global-Stiffness

             Nodal-Force
             Nodal-Displacement

             Element-Force
             Element-Displacement
             Element-Stress
             Element-Plastic-Displacement
             Element-Interaction-Value

     USER TYPE     :  TEXT
     DEFAULT VALUE :  GLOB-DISP

PLOT DATA ITEM ..... / GLOB-DISP / : GLOBAL-LOAD
Postfos:DEFINE-Y-AXIS
PLOT DATA ITEM ..... / GLOB-LOAD / : ELEMENT-FORCE
Postfos:SPECIFY-ELEMENT
ELEMENT ............ /      1 / : 1 3 1
Postfos:SPECIFY-ELEMENT
ELEMENT ............ /      1 / : 2 3 1
Postfos:SPECIFY-ELEMENT
ELEMENT ............ /      1 / : 3 3 1
Postfos:SPECIFY-ELEMENT
ELEMENT ............ /      1 / : 4 3 1
Postfos:PRINT-PLOTFILE
<LCS/LST 1> ........ /      0 / :
<LCS/LST 2> ........ /      0 / :
Postfos:LIST-FILE-CONTENT
FILE TYPE .......... / USFO / : PTAB



     ****************************************
     *      USFOS    PLOT    DATA             *
     ****************************************

     Load case   1 /  1  to    1 / 55

                      Element     Element     Element     Element
          Global            1           2           3           4
            load      Midspan     Midspan     Midspan     Midspan
                      X-force     X-force     X-force     X-force

        1.000E+00   2.449E+04   2.447E+04  -2.449E+04  -2.448E+04
        2.000E+00   4.897E+04   4.893E+04  -4.900E+04  -4.896E+04
        3.000E+00   7.344E+04   7.338E+04  -7.351E+04  -7.346E+04
        4.000E+00   9.790E+04   9.782E+04  -9.803E+04  -9.798E+04
 <CR>:
        5.000E+00   1.224E+05   1.222E+05  -1.226E+05  -1.225E+05
        5.500E+00   1.346E+05   1.345E+05  -1.348E+05  -1.348E+05
        5.923E+00   1.449E+05   1.448E+05  -1.452E+05  -1.452E+05
          :           :           :           :           :
          :           :           :           :           :
Postfos:
```

B.2.8 Element force interaction plots

```
Postfos:OPEN-FILE
FILE TYPE ........... / USFO / : PTAB
FILE NAME ........... / / : M-N-INTERACT:PLO

    Opening of M-N-INTERACT:PLO in progress
    Opening succeeded

Postfos:LIST-OPEN-FILES

USFOS analysis File ......... (PACK-TWO-2:USFOS-TEST)ZAYAS:RAF;1
Print File .................. TERMINAL
Plot File, GPGS dependent .... NOT CONNECTED
Plotfile, symbolic format .... (PACK-TWO-2:USFOS-TEST)M-N-INTERACT:PLO;1

Postfos:DEFINE-X-AXIS ELEMENT-FORCE
Postfos:SPECIFY-ELEMENT
ELEMENT ............. /      1 / : 3 3 5
Postfos:DEFINE-Y-AXIA ELEMENT-FORCE
Postfos:SPECIFY-ELEMENT
ELEMENT ............. /      1 / : 3 3 1
Postfos:SPECIFY-ELEMENT
ELEMENT ............. /      1 / : 1
Postfos:PRINT-PLOTFILE...
Postfos:LIST-FILE-CONTENT PTAB



     ******************************************
     *      USFOS    PLOT    DATA              *
     ******************************************

     Load case   1 /  1  to    1 / 55

          Element     Element
                3           3
          Midspan     Midspan
        Y-moment      X-force

       -1.518E+01  -2.449E+04
       -3.134E+01  -4.900E+04
       -4.853E+01  -7.351E+04
       -6.681E+01  -9.803E+04

 <CR>:
       -8.623E+01  -1.226E+05
       -9.618E+01  -1.348E+05
       -1.048E+02  -1.452E+05
       -1.085E+02  -1.494E+05
       -1.167E+02  -1.590E+05
       -1.165E+02  -1.593E+05
       -1.160E+02  -1.602E+05
       -8.817E+01  -1.614E+05
         :           :
         :           :
Postfos:
```

B.2.9 Program termination

```
Postfos:EXIT

--> Normal termination of the  U S F O S  presentation module
    CPU time:  6 Seconds  Clock time: 55 Seconds
```