

Development of Assistant Tools for FEMFAT

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Engineering Center Syteyr

Introduction

- Necessity of supporting tool

Grasp of current condition

- SPOT/WELD pre-processing

- Condition of calculation

Target for FEMFAT

- Decreasing human error & labor

- Establishing self-standard mode

Analysis process

- Management of analysis flow with ASIST

Assistance for preprocessing

- Definition of SPOT

- Definition of WELD

Assistance for calculation

- Self-standard mode of FEMFAT

Display of output

- Display of damage

Summary

■ Necessity of supporting tool

Offer of unification environment to calculation technicians.

Decrease of human labor and increase in efficiency for calculation technicians

- Operating plural software

Including FEMFAT, NASTRAN and TOPAZ etc

#1: TOPAZ is a house-made pre-postprocessor of HONDA.

- Troublesome starting operation of software
- Effective use of waiting time in Job submitting

Human error decrease in analysis

- Unit conversion function
- Self-standard mode for calculation technicians

■ SPOT/WELD preprocessing

Definition of SPOT/WELD

When we analyze with FEMFAT, **various setups should be necessary** including a result of stress analysis. Especially in case of body analysis, the evaluation of the welded section is important. And FEMFAT-SPOT/WELD is effective to these evaluations. There are problems that, on the other hand, **it takes much time to define the welded condition.**

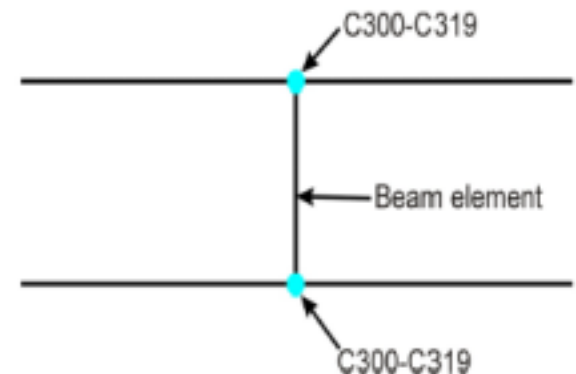
Definition of SPOT

Editing of the structural model

Definition of spot welded section before “Spot Preprocessing”

→ Editing of node number for Spot welded section

Setup time : 1day for full vehicle



Grasp of Current Condition



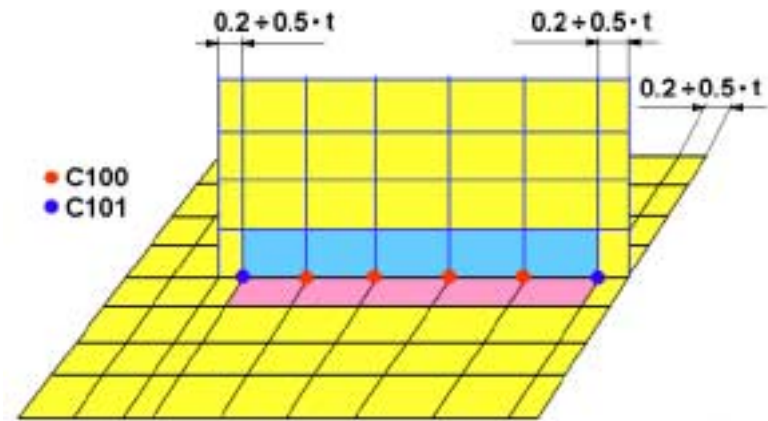
SPOT/WELD preprocessing

Definition of WELD

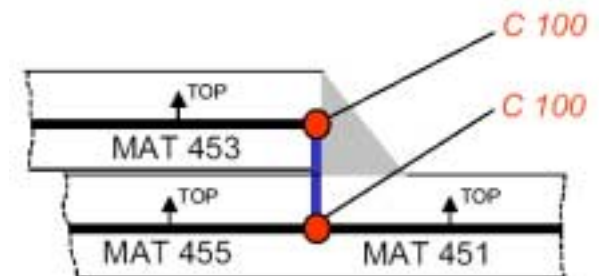
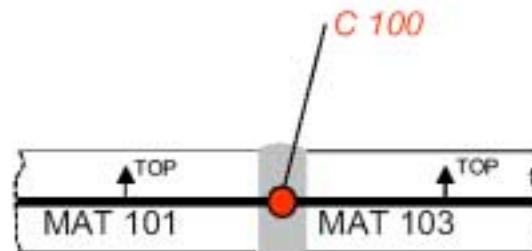
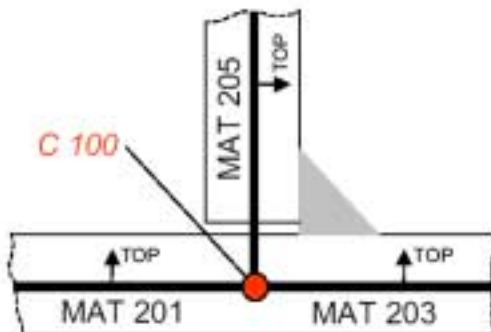
Editing of the structural model

Definition of arc welded section

→Editing material card and node number of arc welded section



Setup time : 4days for suspension parts



■ Condition of Calculation

Conversion of Unit

Unit for FEMFAT:SI Unit (Weight:kg/Force:N/Length:mm)

Current Unit for us :Engineering unit

Editing of the structural model

Various analysis condition

Because FEMFAT has many parameters,
each calculation technicians can establish more complex analysis conditions.



It is difficult to compare the result calculated by different person.



A self-standard analysis condition is necessary.

Target for FEMFAT



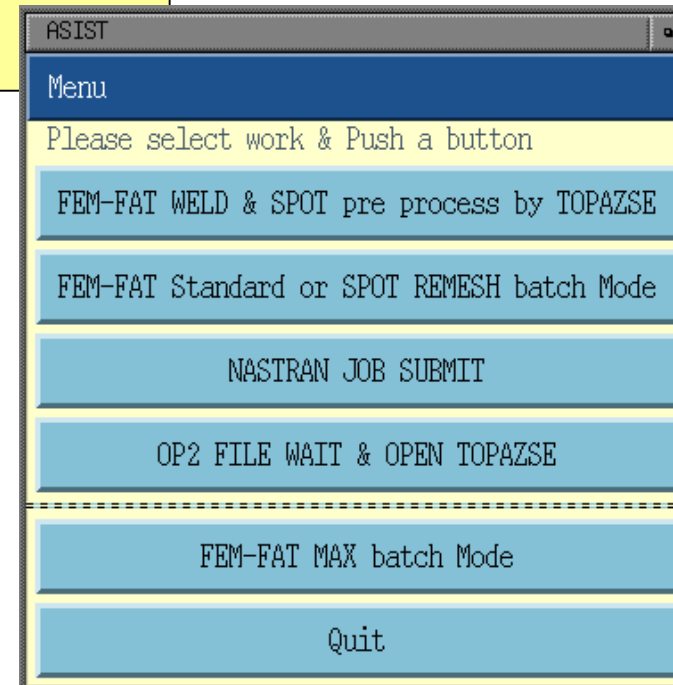
■ Decreasing human error & labor Establishing self-standard mode



- Much labor to set SPOT/WELD & Unit Conversion
- Anxiety for Human Error
- Various calculation condition could be set

Assistance with computer
for human operation

Decreasing human error & labor
Establishing self-standard mode

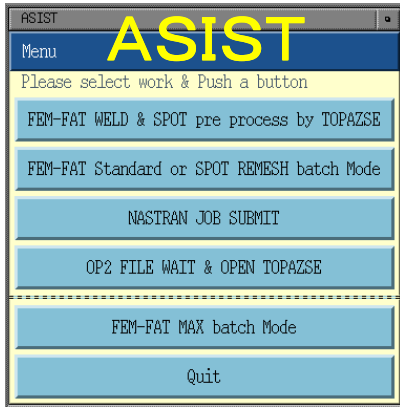


Management of analysis flow with ASIST

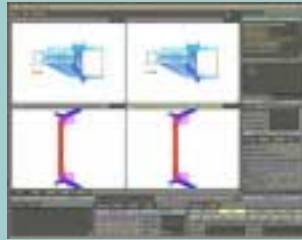
-Plural tools operations are integrated by ASIST.

Analysis time
5days ⇒ 1.0hour

A menu is carried out in order. →

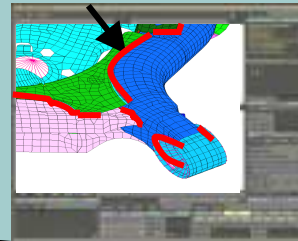


- Reading model
- An automatic change to the SI unit



Amendment of welded section

- Spot definition(Node No.)
- Arc weld definition(Node No. & MAT Card)

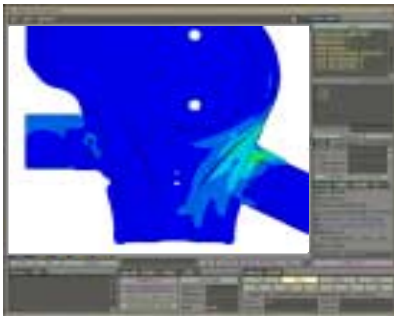


Automatic recognition of Welding line

- Stress analysis

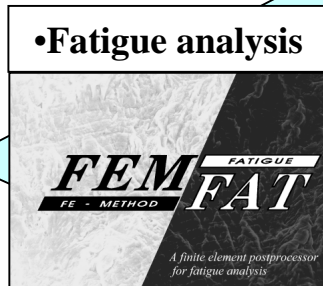


- Show the result of Fatigue analysis

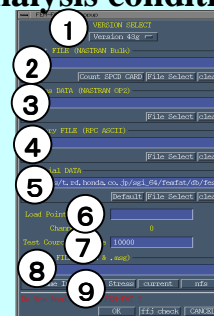


TOPAZ
Customization of House-made software

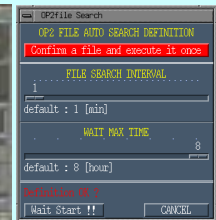
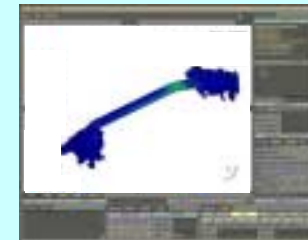
- Fatigue analysis



- Definition of analysis condition



- Watching a calculation end
- Seamless confirmation of a result



- Self-standard mode
- '0' human error

Human error & labor
Self-standard mode

■ Definition of SPOT

Automatic editing of the structural model

Editing of the node number of spot section

Preprocessor of TOPAZ for SPOT

Select joint type

Joint Type (Coordinate ID.) 301

'Spot' C301-C319 'Riveted' C320-C339
'Clinch' C340-C359.

Pick Beam Elements

Delete picking mode.

Property ID.

All simple beam elements (CBAR) of 'PID' which it was input into is established.

10 / 10

Joint type

- C300 spot (*)
- C301 - C319 spot weld
- C320 - C339 rivet
- C340 - C359 clinch

SPOTWELD	C301	386
SPOTWELD	C301	385
SPOTWELD	C301	384
SPOTWELD	C301	383

Select CBAR from the model

Joint Type (Coordinate ID.) 301

'Spot' C301-C319 'Riveted' C320-C339
'Clinch' C340-C359.

Pick Beam Elements

Delete picking mode.

Property ID.

All simple beam elements (CBAR) of 'PID' which it was input into is established.

10 / 10

SPOTWELD	C301	772
SPOTWELD	C301	771
SPOTWELD	C301	770
SPOTWELD	C301	769
SPOTWELD	C301	768
SPOTWELD	C301	387
SPOTWELD	C301	386
SPOTWELD	C301	385
SPOTWELD	C301	384
SPOTWELD	C301	383

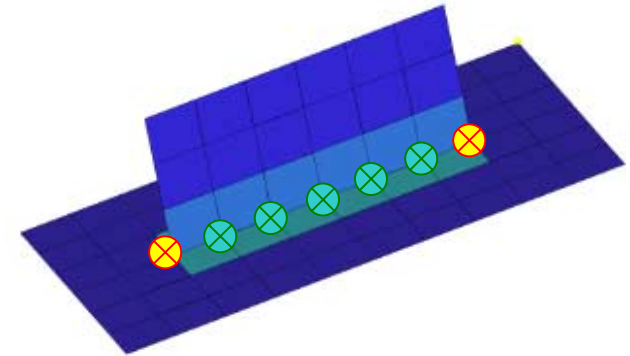
Defined CBARs are always indicated

■ Definition of WELD

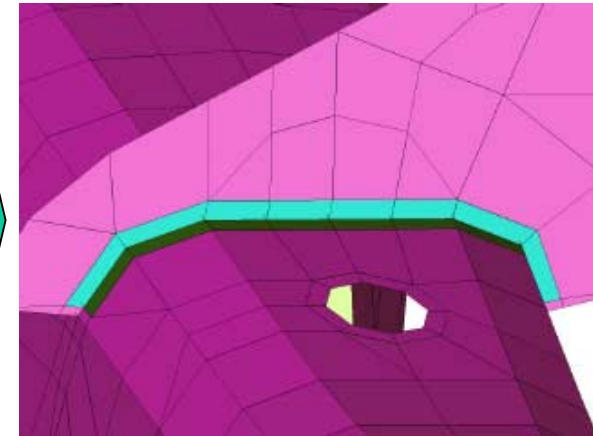
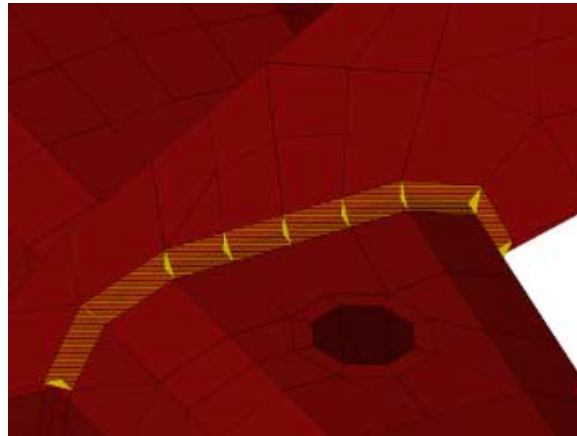
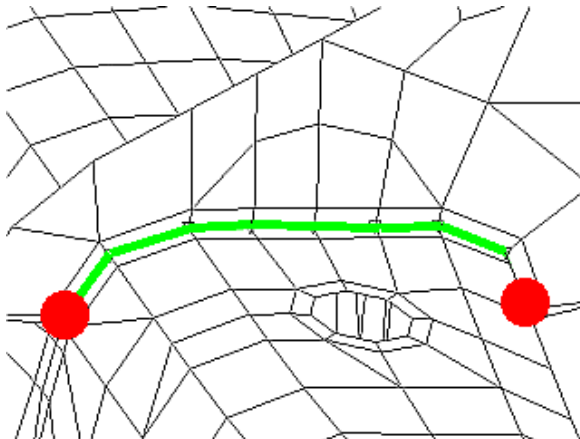
Automatic editing of the structural model

→ Editing of material card and node number of the arc welded section

Addition of MAT1 card	:welded form
Addition of PSHELL card	:welded form
Addition of COORD2R card	:joint type
Change of CID (displacement coordinate) of the GRID card	:joint type
Change of the properties of the SHELL card	:welded form



⊗ Welded end
⊗ General welded area



■ Definition of WELD

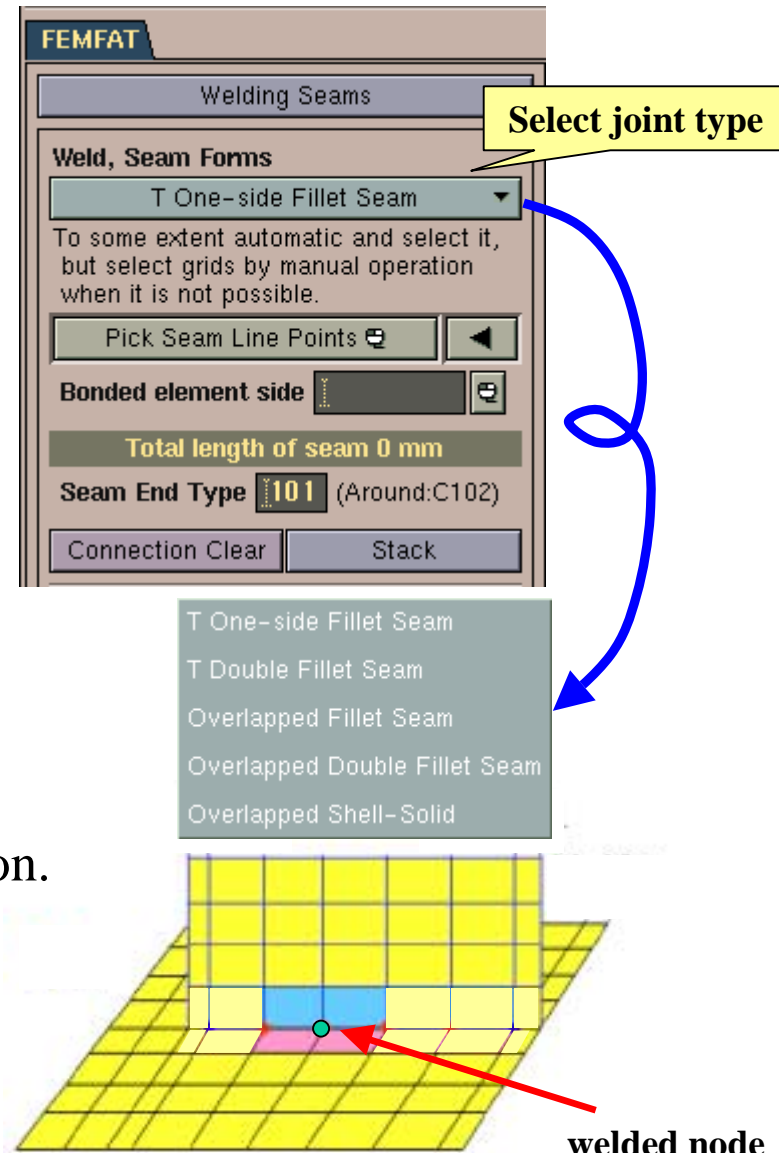
Automatic numbering of structural model

→ Editing of material card of arc welded section

Algorithm of changing material number of welded bonding.

- 1: Counting how many pieces of **shell elements attached to the welded node**.
- 2: Selecting **type of joint**, T-joint, Overlapped-joint or Cross-joint
- 3: Recognizing **related position of plates** with the normal vector for shell element.
- 4: **Editing material card** of the arc welded section.

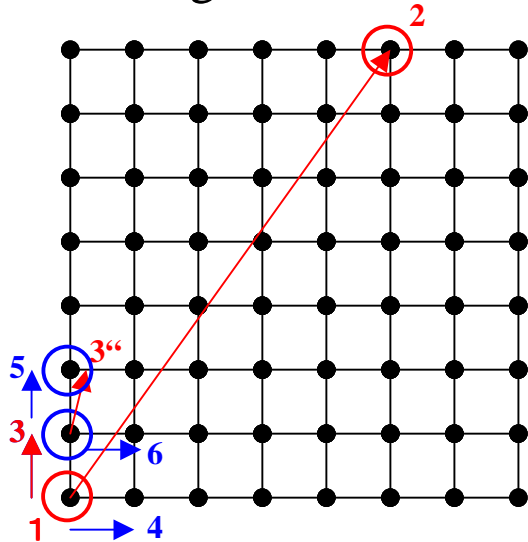
Preprocessor of TOPAZ for WELD



■ Definition of WELD

Automatic search technique of the welding line (detail)

Search algorithm



■ Searching direction from starting point

to ending point step by step

1st. step

#1:Deciding a vector from red circle 1 to red circle 2

#2:Choosing a direction from either vector13 or vector14.

#3:Direction 13 is chosen, because the angle between vector 12 and vector 13 is smaller than that of between vector 14 and vector12.

2nd. Step

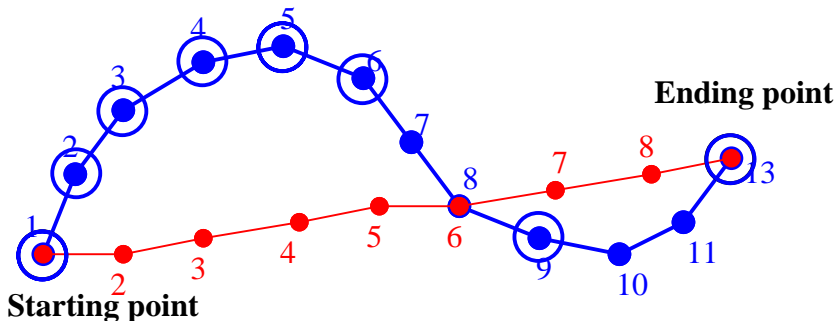
#1:Same process with 1st. step. **Following, repeatedly**

This searching method was devised individually. This algorithm is named as “Moving average searching” in our company.

Semi-automatic selection

■ Switching continuous selection way and

skipping selection way



Just setting starting point and ending point

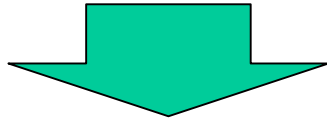
⇒ Red route is selected

Switching to skipping selection way

⇒ Blue route can be selected set step by step.

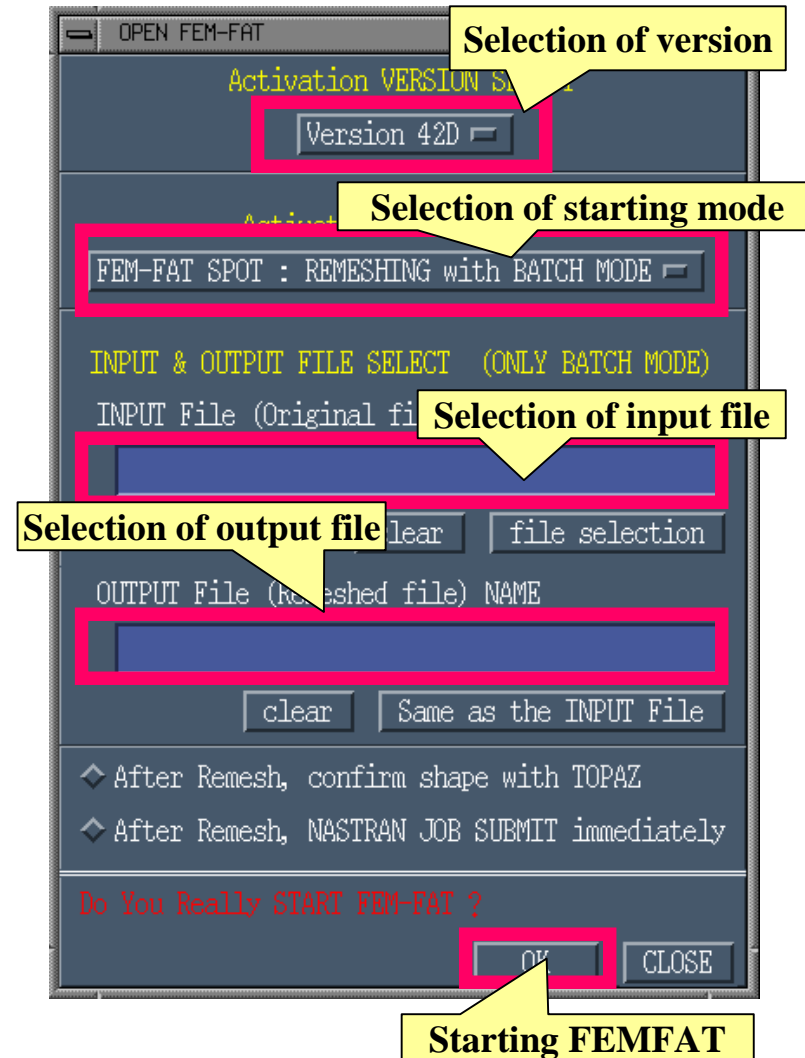
■ Automatic setup for FEMFAT-SPOT

Batch processing of SPOT Preprocessing
by using “Remesh.ffj File”



An analysis expert can set up in detail.
A calculation technician can't changed it.

Guidelines are necessary as a Re-mesh condition,
As for MRATIO and RFAKT.



Assistance for calculation

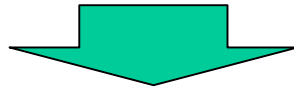


■ Self-standard mode of FEMFAT

A calculation method for the technician

Default of FEMFAT ~~≠~~ User default

Batch processing of calculation condition of FEMFAT by using “Max.ffj File”



An analysis expert can set up in detail.
A calculation technician can't changed it.
Same as “Automatic setup for FEMFAT-SPOT”

Self-standard mode of HONDA

FEM-FAT MAX_popup

VERSION SELECT
Version 43g

Input FILE (NASTRAN Bulk)
[Text Field]
Count SPCD CARD File Select clear

Stress DATA (NASTRAN OP2)
[Text Field]
File Select clear

History FILE (RPC ASCII)
[Text Field]
File Select clear

Material DATA
/afs/t.rd.honda.co.jp/sgi_64/femfat/db/fes
Default File Select clear

Load Point (Number) [Text Field]
Channel 0

Test Course Distance 10000

Output FILE (.dma & .msg)
[Text Field]
Same Input Same Stress current nfs

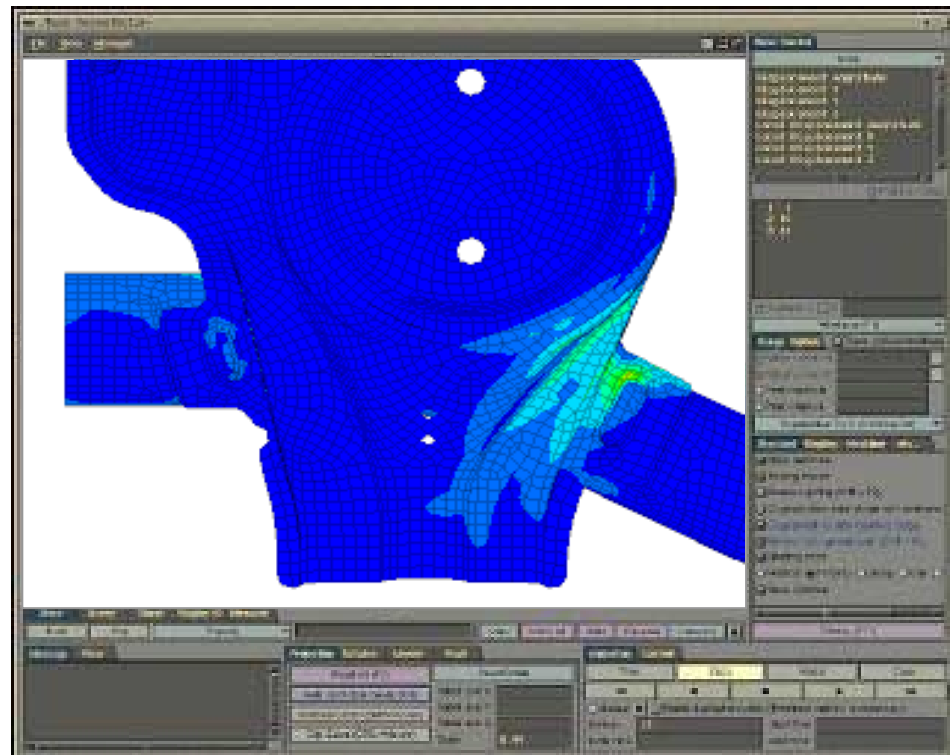
Do You Really Start FEM-FAT ?
OK ffj check CANCEL

Human error & labor
Self-standard mode

■ Display of Damage

Easy operation and reducing human error

- Specified function menu from our own user's necessity
- Easy countermeasure for necessity from the various users
- Accustomed usage of display with stress result
- License free



■ The original assistant tool for FEMFAT

- Pre-processor and post-processor for FEMFAT
 - TOPAZ: Automatic definition for welded area
 - TOPAZ: Visualization of FEMFAT result
- Self-standard mode of FEMFAT
 - ASIST: Management of analysis flow
- FEMFAT Calculation with ASIST saves time & money

END