FRANC3D Training Workshop: Part 4

FRANC3D User Interface

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Workshop Agenda

- Part 1: Introduction to Fatigue and Damage Tolerance
- Part 2: Introduction to Fracture Mechanics Analysis
- Part 3: Introduction to FRANC3D
- Part 4: FRANC3D User Interface
- Part 5: Finite Element (FE) Model Import
- Part 6: Crack Insertion
- Part 7: Static Crack Analysis & SIF Computation
- Part 8: SIFs from FE Analysis
- Part 9: Crack Growth
- Part 10: SIF History & Fatigue Life
- Part 11: Miscellaneous Topics

FRANC3D User Interface

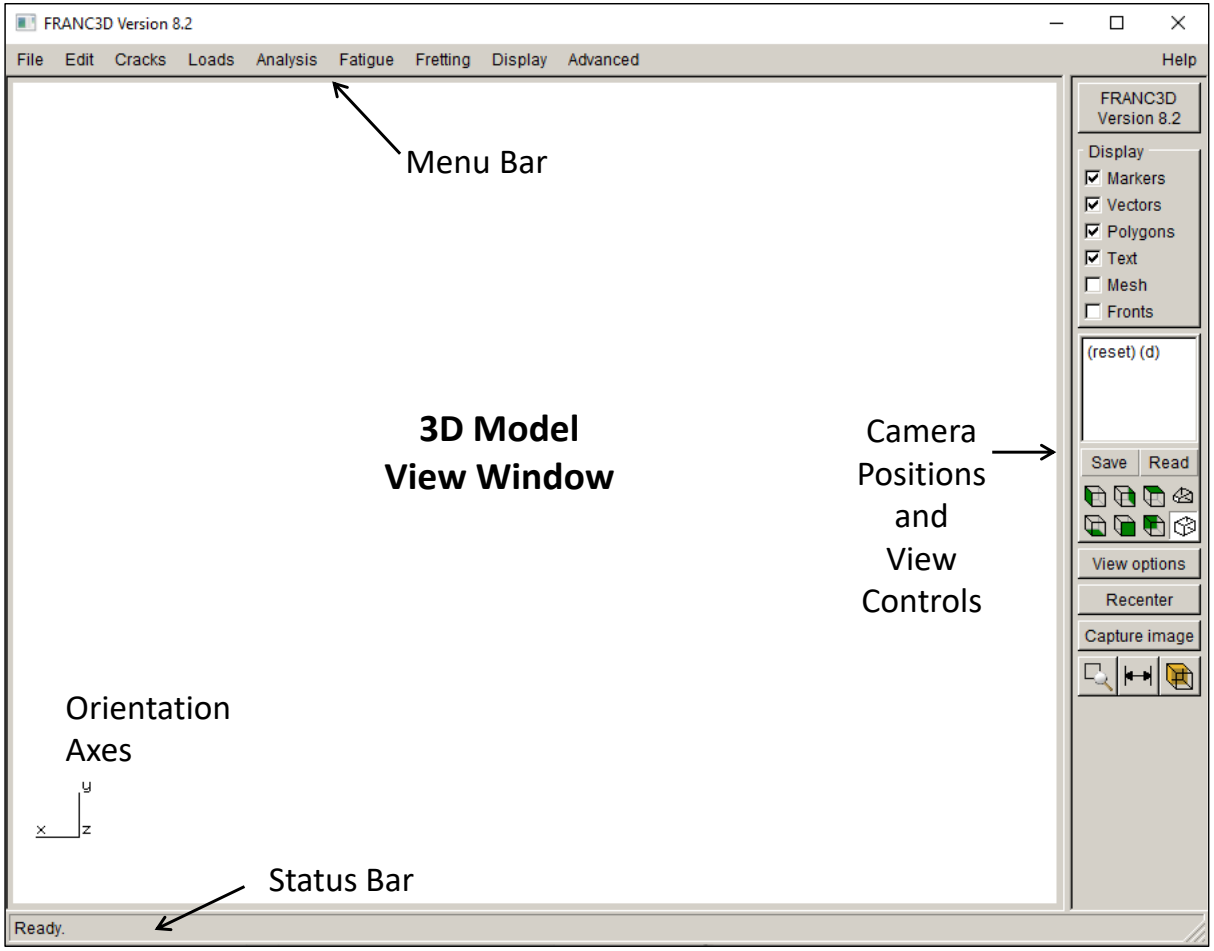
- FRANC3D Main Window
- 3D View Manipulation
- Menus
- Preferences
- FRANC3D Files
- FRANC3D Session Log

FRANC3D Main Window

The view manipulations are:

- Rotate (left mouse button, no keyboard keys)
- Pan (center mouse button or wheel, no keyboard keys)
- Zoom/Spin (right mouse button, no keyboard keys)
- Front Clip (center mouse button or wheel plus shift key)
- Back Clip (right mouse button or wheel plus shift key)

These defaults can be modified in the Preferences.



3D View Manipulation

Graphical Element Toggles

Named Camera Positions

Preset Camera Positions

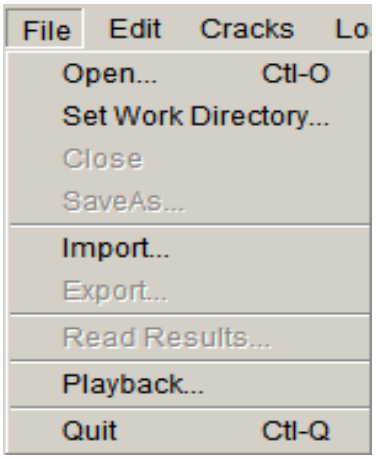
View Options

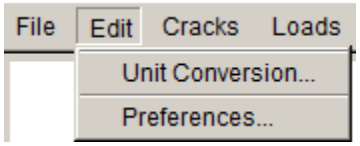
View options: displays a dialog that allows one to change the rotation, pan and zoom speeds.

Recenter: allows one to change the center of rotation.

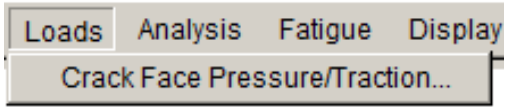
Capture: Displays the Save File As dialog. The current view of the model is captured and saved to a file. Either a .png or .jpg file can be saved.

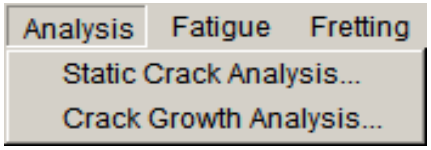
Menus

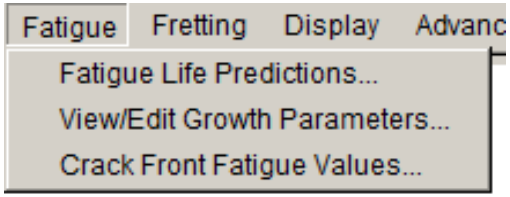

File
Edit
Cracks
Lo
Open... Ctl-O
Set Work Directory...
Close
SaveAs...
Import...
Export...
Read Results...
Playback...
Quit Ctl-Q

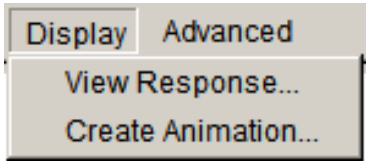

File
Edit
Cracks
Loads
Unit Conversion...
Preferences...


Cracks
Loads
Analysis
New Flaw Wizard...
Flaw From Files...
Multiple Flaw Insert...
Compute SIF's...
Grow Crack...
Read Crack Growth...
Grow/Merge Cracks...
Edit Crack Geometry...
SIF's Along a Path...
SIF's For All Fronts...

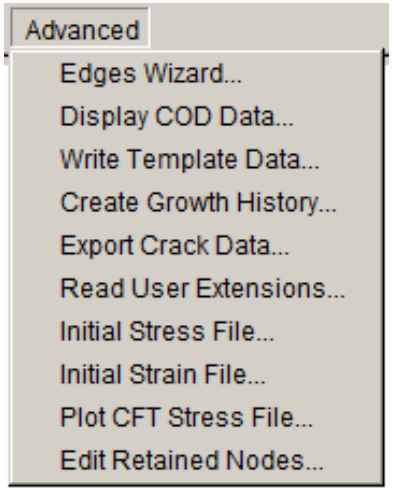

Loads
Analysis
Fatigue
Display
Crack Face Pressure/Traction...

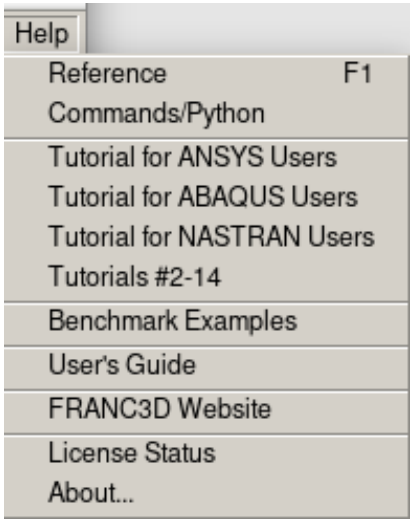

Analysis
Fatigue
Fretting
Static Crack Analysis...
Crack Growth Analysis...

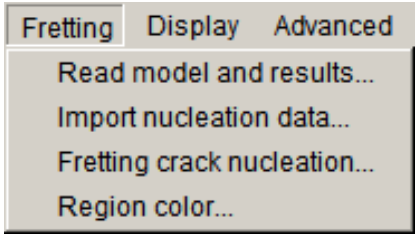

Fatigue
Fretting
Display
Advanc
Fatigue Life Predictions...
View/Edit Growth Parameters...
Crack Front Fatigue Values...

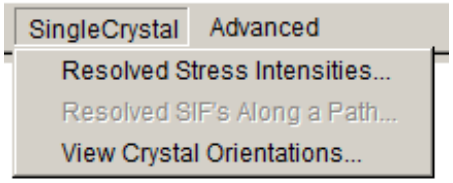

Display
Advanced
View Response...
Create Animation...

Menus


Advanced
Edges Wizard...
Display COD Data...
Write Template Data...
Create Growth History...
Export Crack Data...
Read User Extensions...
Initial Stress File...
Initial Strain File...
Plot CFT Stress File...
Edit Retained Nodes...


Help
Reference F1
Commands/Python
Tutorial for ANSYS Users
Tutorial for ABAQUS Users
Tutorial for NASTRAN Users
Tutorials #2-14
Benchmark Examples
User's Guide
FRANC3D Website
License Status
About...

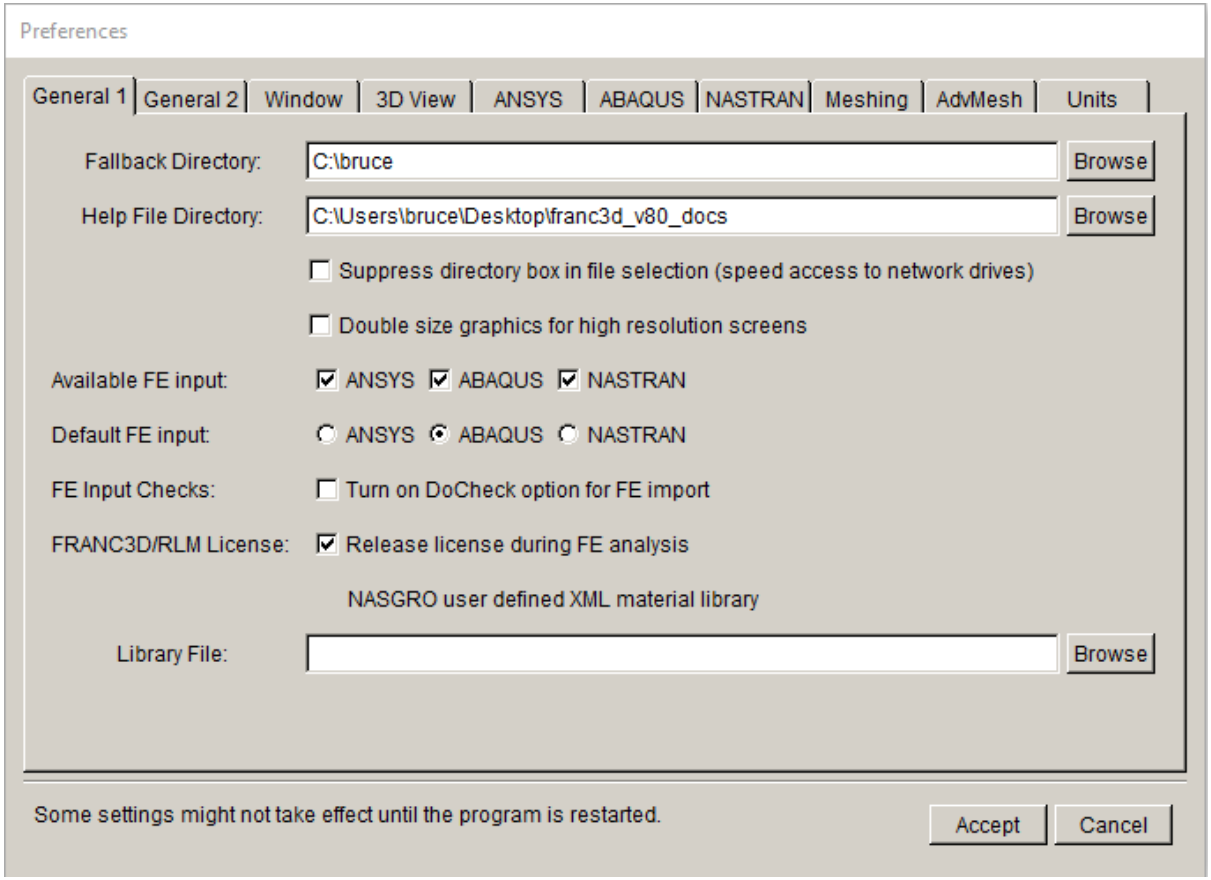

Fretting
Display
Advanced
Read model and results...
Import nucleation data...
Fretting crack nucleation...
Region color...


SingleCrystal
Advanced
Resolved Stress Intensities...
Resolved SIF's Along a Path...
View Crystal Orientations...


Electrical
Advanced
Electrostatic Energy Release Rates...

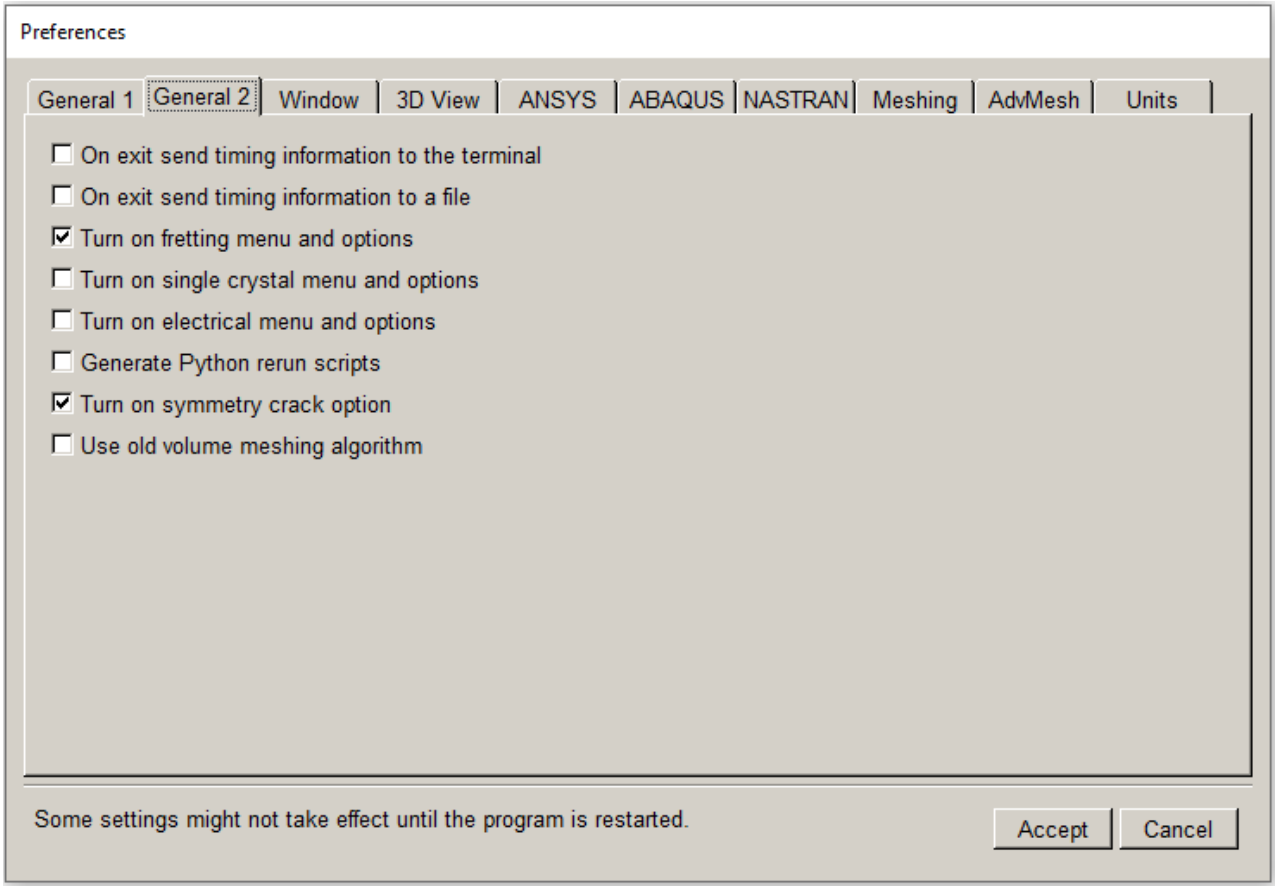
Preferences

- Selecting the Edit →Preferences menu item invokes the Preferences dialog, which allows one to set program-wide configurations.



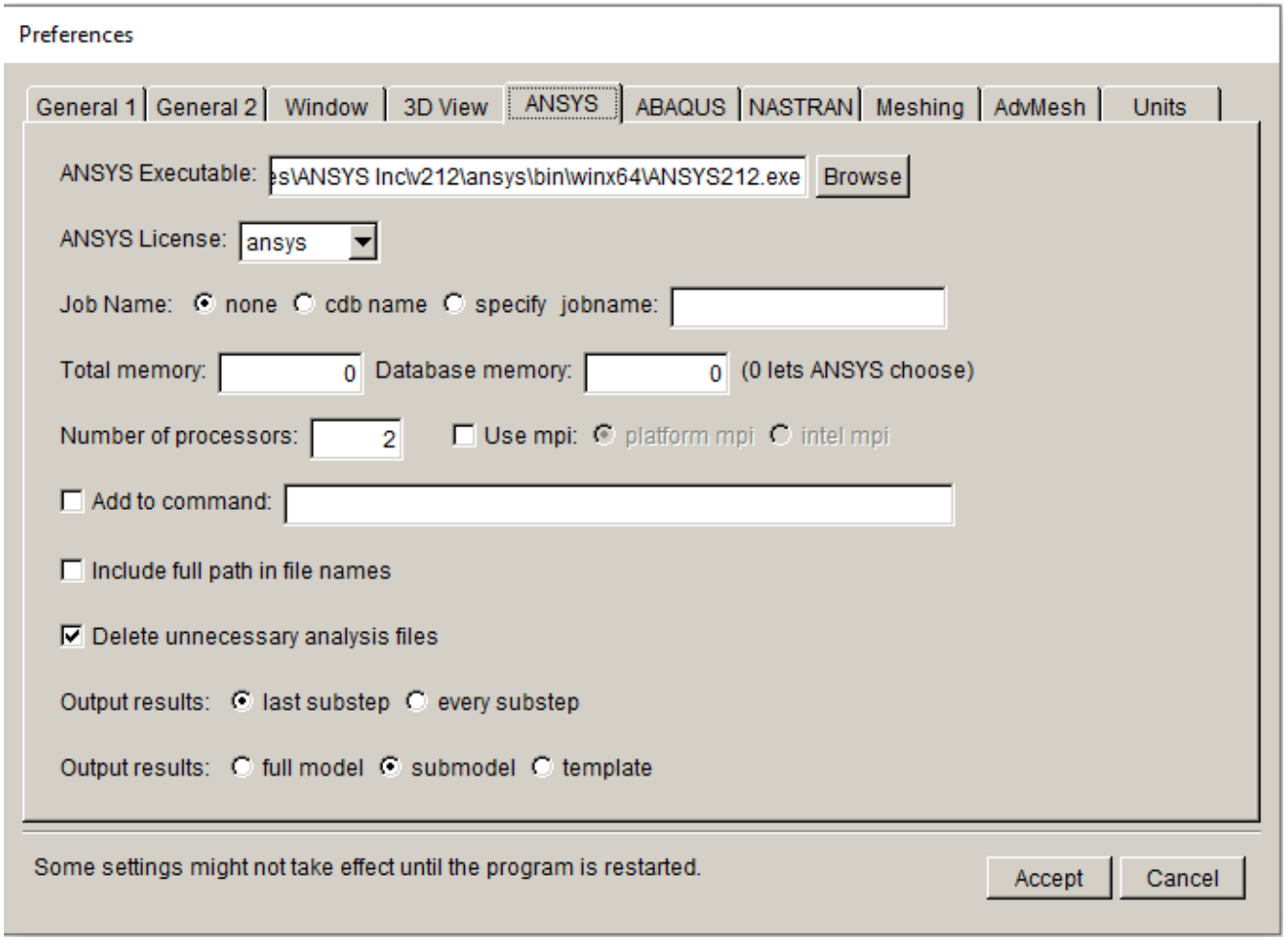
Preferences Tabs

- General 2 Tab



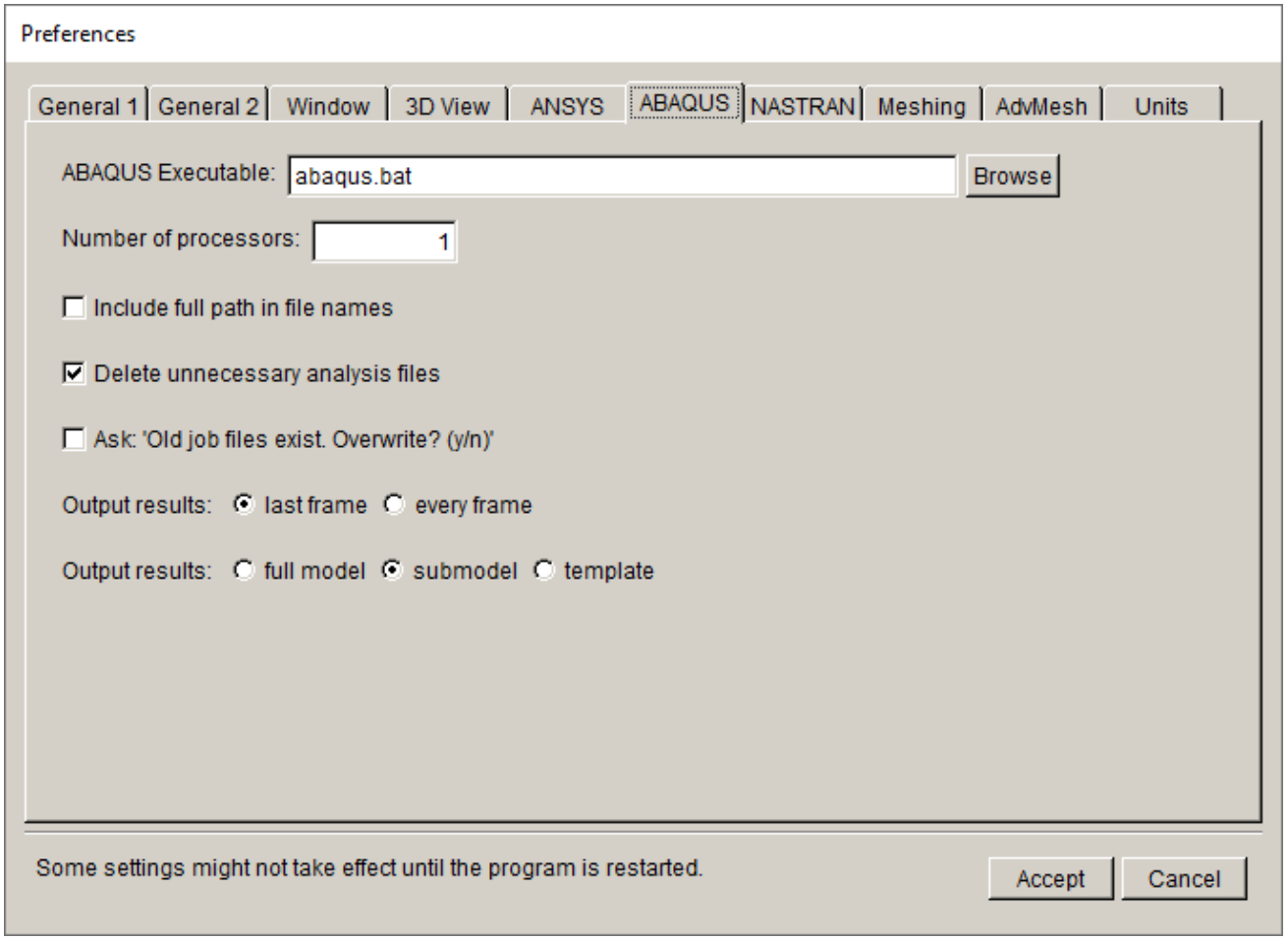
Preferences Tabs

- ANSYS Tab



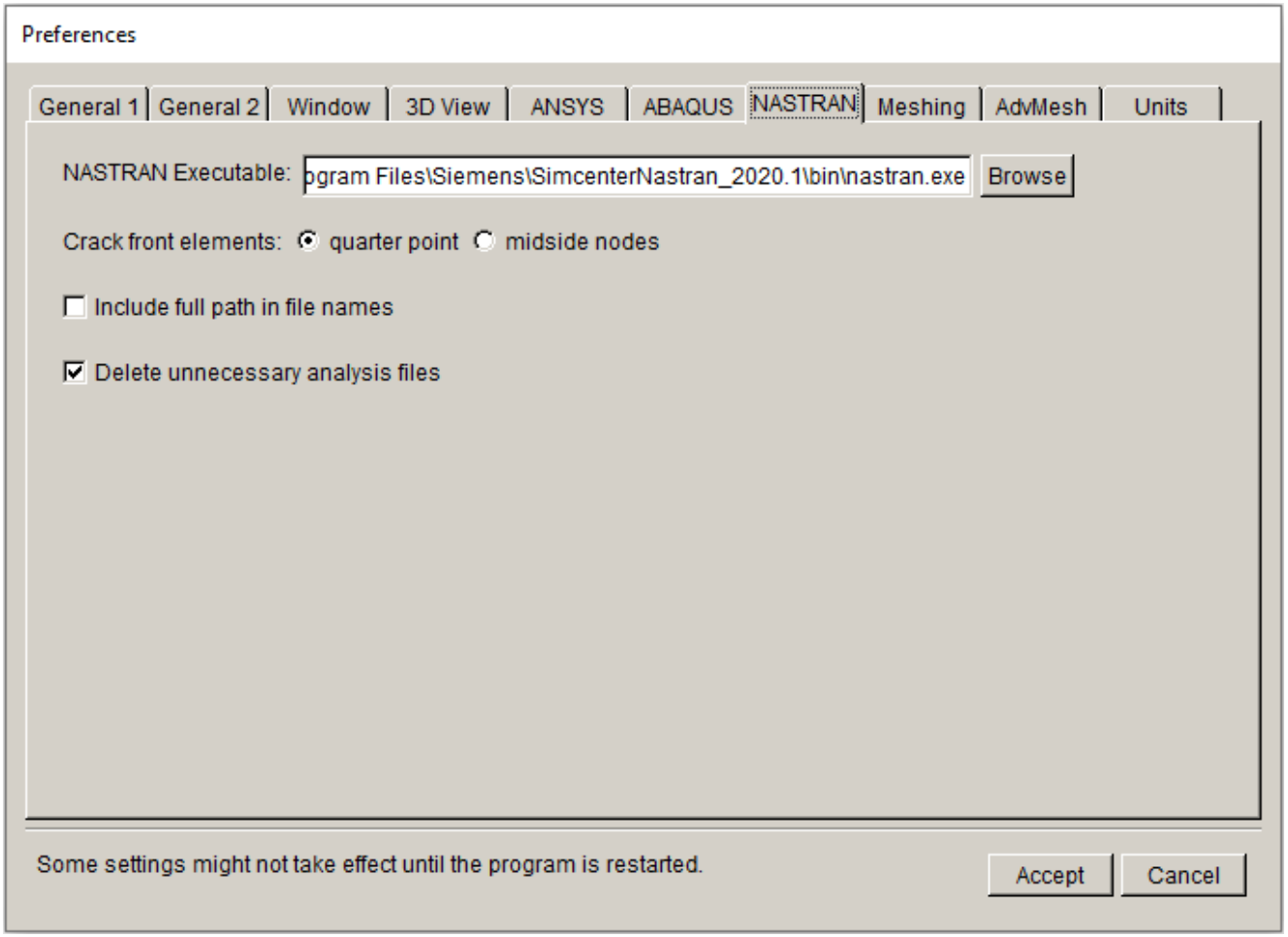
Preferences

- ABAQUS Tab



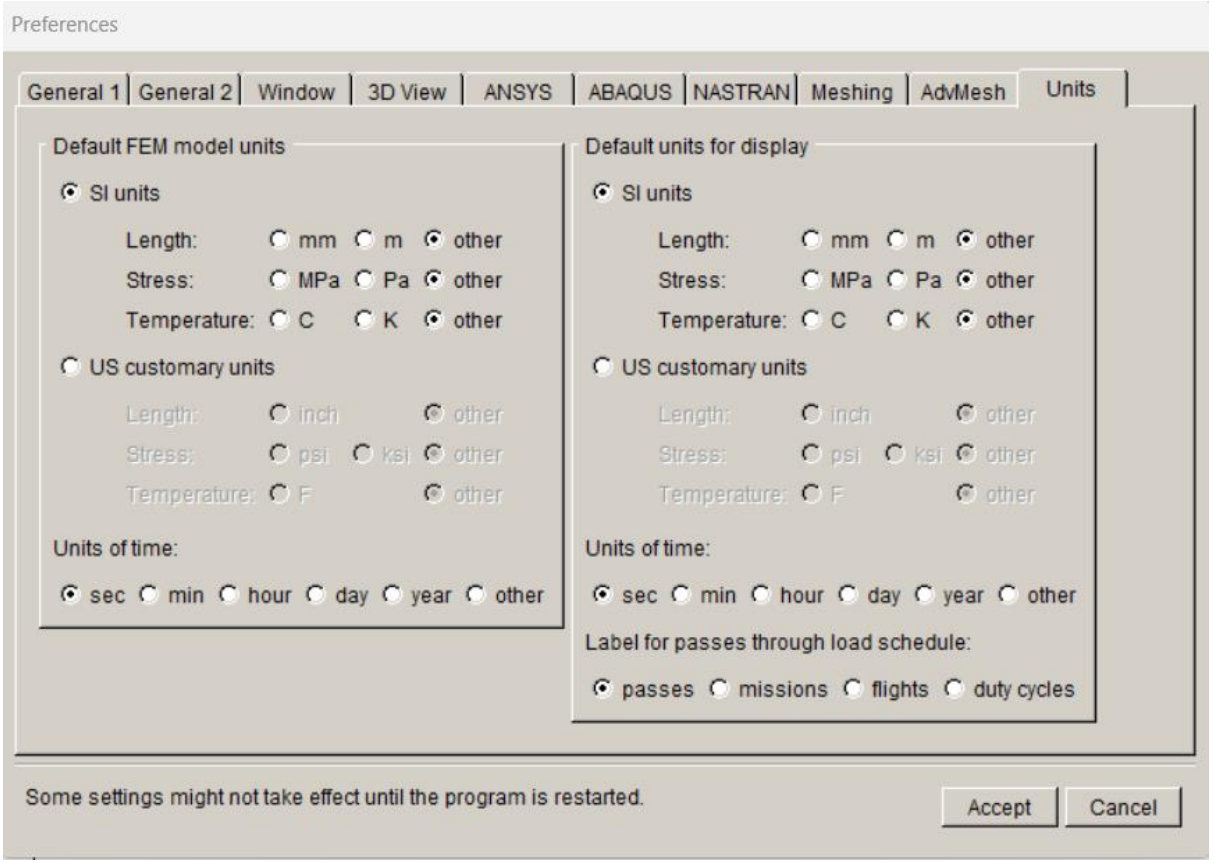
Preferences

- NASTRAN Tab



Preferences

- Allows the user to set default units for the FE model and for display



Preferences

- Preferences are stored in a database that is read when FRANC3D is started.
- Some Preference settings might not take effect until the program is restarted, so if you change settings, it is best to quit and restart.

FRANC3D Files

.fdb – FRANC3D restart file
stores crack geometry, growth model, SIF history,
reference to other files described below

.cdb/.inp/.bdf – original uncracked FE model and cracked FE model files

.dtp – results file with displacements, temperatures, contact pressures

.crk – crack geometry

.log – GUI session log file contains FRANC3D commands

.fcg – fatigue crack growth data (SIF history and crack growth model)

STEP###.* – automatically named and numbered crack growth step files

FE analysis code files: *i.e.* .db & .rst for ANSYS, .odb for ABAQUS

Analysis Results

- **File → Read Results** menu item allows one to choose the analysis results file.
- For ANSYS, FRANC3D reads
  - *.dtp file (contains displacements, temperatures, contact pressure) that is created using the ANSYS APDL macro generated by FRANC3D
- For ABAQUS, FRANC3D reads
  - *.dtp file (contains displacements, temperatures, contact pressure) that is created using the FRANC3D generated ABAQUS Python script
- For NASTRAN, FRANC3D reads
  - *.pch file, which contains displacements; temperatures are based on the input temperature for the uncracked model

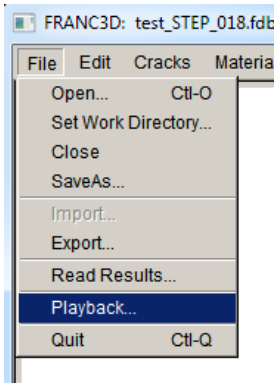
FRANC3D Session Log and Playback

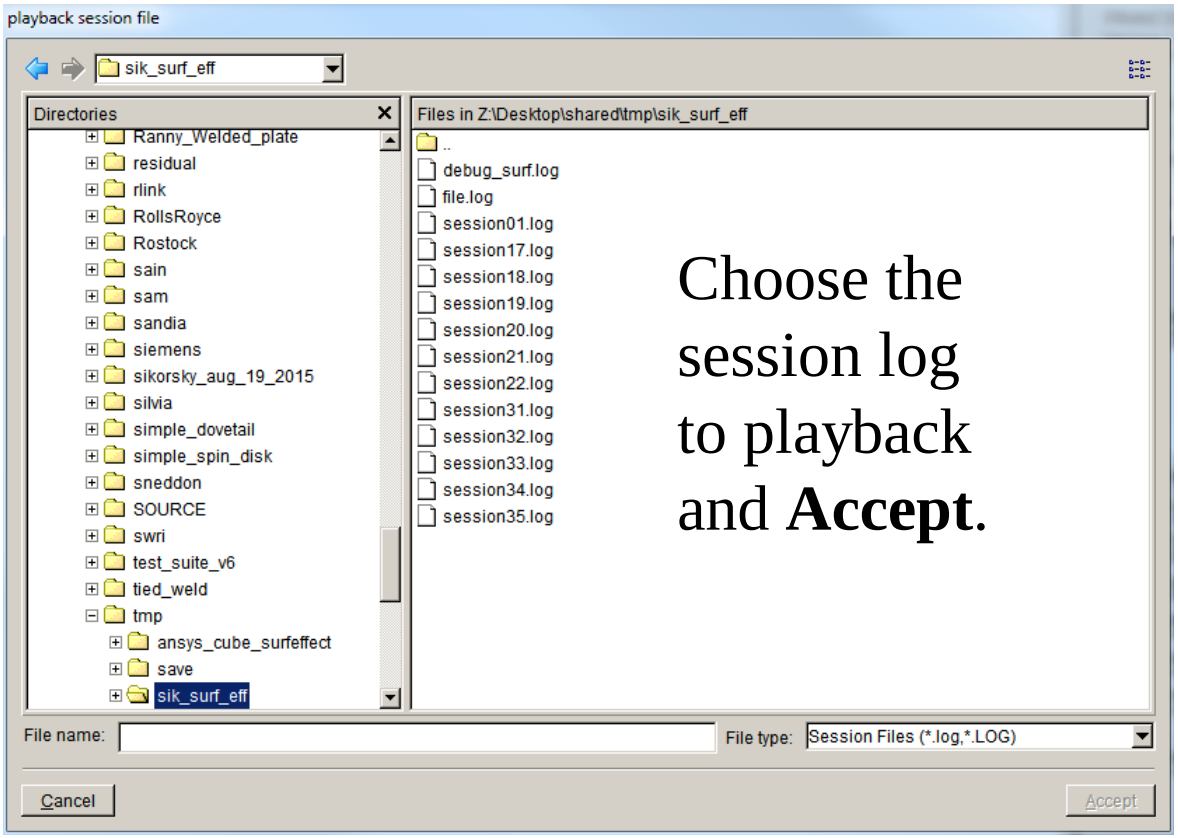
A session##.log file is saved for each FRANC3D GUI session. As GUI commands are executed, each command is written to the session log. An example session:

```
OpenMeshModel(
   model_type=ANSYS,
   file_name='cube_orig.cdb’,
   retained_nodes_file='cube_orig_RETAINED.txt')

InsertFileFlaw(
   file_name='test.crk',
   radius=0.0081)

RunAnalysis(
   model_type=ANSYS,
   file_name='test.fdb',
   flags=[TRANSFER_BC,NO_CFACE_TRACT,NO_CFACE_CNTCT],
   connection_type=MERGE,
   command='"ANSYS222.exe" -b -p ansys -i "test.macro" -o "test.out“’)

ComputeSif(
   do_therm_terms=true,
   ref_temp=71.6)
```

FRANC3D Session Log and Playback

The session can be played back in the GUI:
from FRANC3D menu, choose **File → Playback**





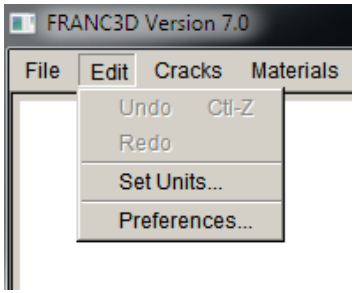
Choose the session log to playback and **Accept**.

The log file can also be played back from a Command/Terminal:

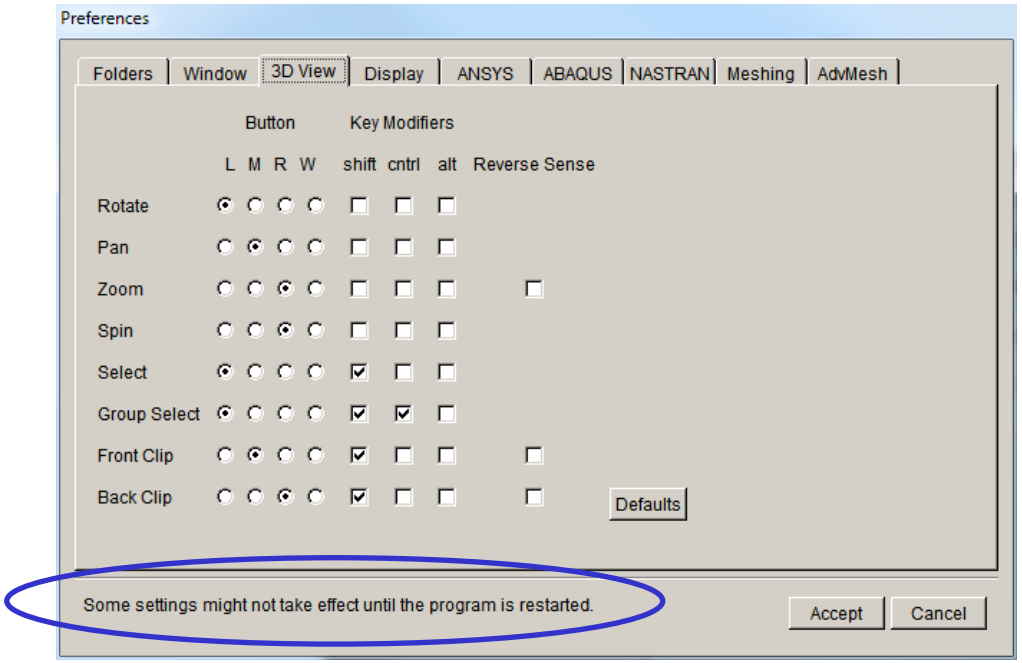
- franc3d -batch ses.log

Demo/Hands On (Homework):
Set Preferences,
Work Directory
and Units

FRANC3D Tutorial 1 – before you start



Set your Preferences, **Accept** and then quit and restart FRANC3D.



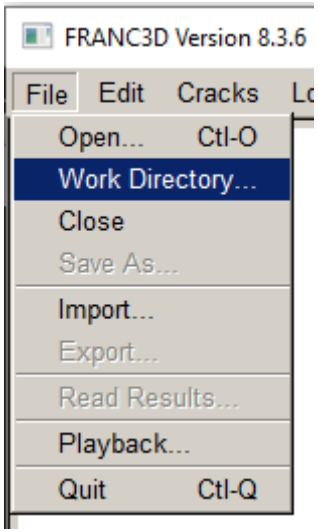
It is usually best to quit and restart the program after changing settings.
Settings are saved to text file in user's home folder:

franc3d.ini for MS Windows

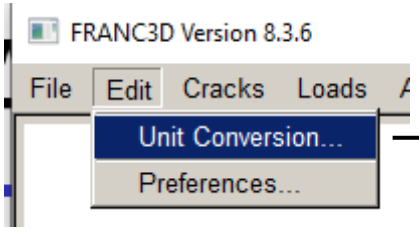
.franc3d.rc for Linux

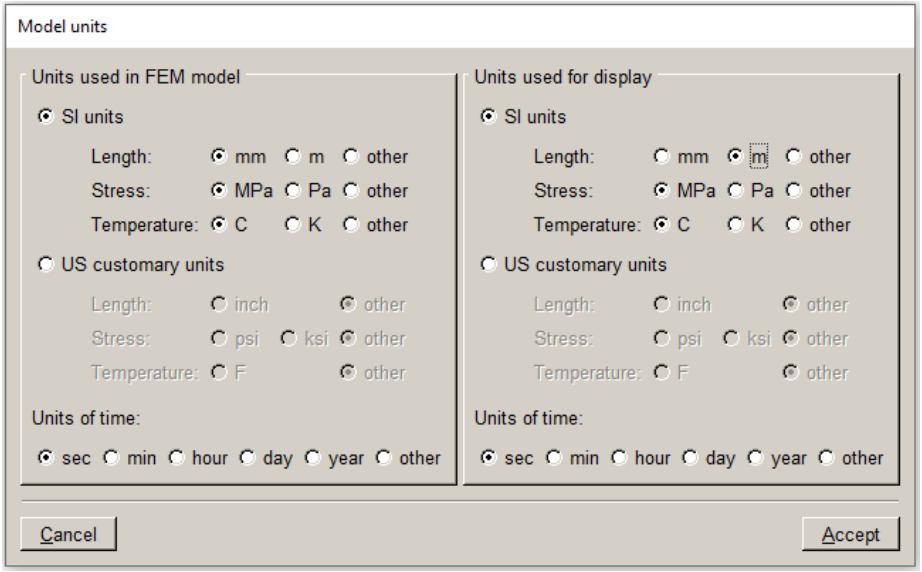
FRANC3D Tutorial 1 – before you start

Set your Work Directory and your FE model units.



Use separate folders for each new model.
Lots of files are generated during analysis and growth.





Demo & Hands On (Homework): Download Tutorial Doc / Files

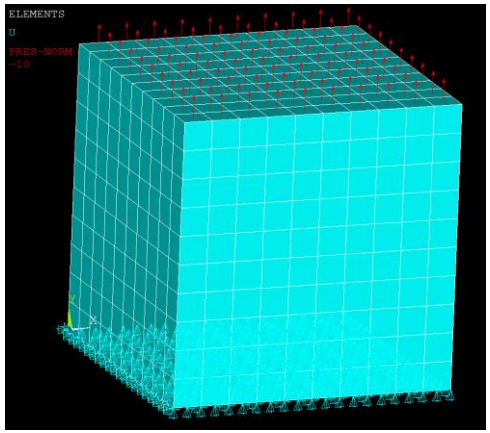
FRANC3D Documentation

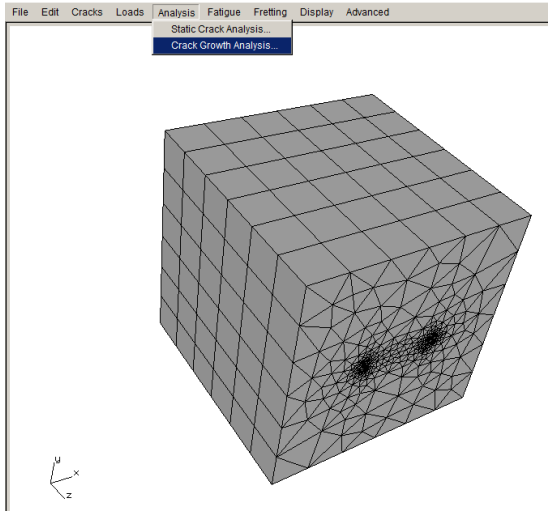
- Download & Install Instructions
- Brochure
- Reference Manual
- Tutorial for ABAQUS Users
- Tutorial for ANSYS Users
- Tutorial for NASTRAN Users
- Tutorial for SIERRA Users
- Tutorials 2-14
- User's Guide
- Command Line & Python Interface
- Benchmark Reference

Training Slides

- Download Files

Tutorial #1:
Crack Insertion and Growth in a Cube





http://www.fracanalysis.com/software.html

End Part 4