Changes to FRANC3D from Version 7.5.5 to 7.5.6

Jul 28, 2021

1) Fix TotalPasses value that is output to the .fdb file.
2) Catch potential issue of 'infinite' crack growth rate returned for dadN vs dK.
3) Turn off 'simple' propagation for interior cracks with high positive and negative kink angles.

Changes to FRANC3D from Version 7.5.4 to 7.5.5

Jun 17, 2021

1) Copy node rotation for any node in AUTO_CUT_SURF (for cases where the cut surface nodes are also on the model surface).
2) Fix some issues with copying ABAQUS *output requests.
3) Fix issue with NASTRAN native element reader.
4) Fix issue adding a CFT load to an existing load step (loads were not output for subsequent crack growth steps).
5) Check for empty current load step map when deleting a CFT load step.
6) Catch potential crashes when computing SIFs using bad or wrong results files.
7) Clear existing SIFs for the current crack step before reading results files.
8) Catch incorrect format errors when reading .fdb files and inform user.
9) Catch attempts to read Version 8 .fdb files and inform user.

Changes to FRANC3D from Version 7.5.3 to 7.5.4

Apr 27, 2021

1) Add support for ABAQUS Riks keyword.
2) Allow user to turn on/off ABAQUS Nlgeom setting when applying crack face contact.
3) Fix issue handling a space and quote in ABAQUS set name.
4) Check for tab character in NASTRAN input files.
5) Fix SIF path and fatigue life path for the user defined plane path option.
6) Transfer node rotations on cut-surface nodes that also fall on the model surface.
7) Add some additional GUI checks on surfaces/sets for local + global connections.

Changes to FRANC3D from Version 7.5.2 to 7.5.3

Feb 5, 2021

1) Fixed an issue with format/display of equations for crack growth rate plots.
2) Fixed y-axis units label for da/dN vs dK plot.
3) Fixed XY plot y-axis format for near-flat-line data.
4) Fixed ANSYS extraneous file cleanup for –smp and multiple processors.

5) The previous ABAQUS load step solver options are applied to extra crack face traction (CFT) load steps.
6) Fixed an issue with ABAQUS models with CENTRIF type loading applied to multiple element sets (or regions).
   NOTE: there is a limitation; the local model cannot contain the entire element set. Part of the element should be stored with the global portion, otherwise franc3d will determine that the CENTRIF loading is applied to a non-existent element set and discard the load.

Changes to FRANC3D from Version 7.5.1 to 7.5.2

Jan 11, 2021

1) Fixed issue when closing the SIFs dialog when displayed from the crack growth wizard.
2) Added the do_epj flag to the ComputeSifs command or session log to compute elasto-plastic J.
3) Added the WriteEPJ to PyF3D module to save the elasto-plastic J values.
4) Fixed an issue with crack front template parameters not being set correctly during playback of command or session log files.
5) Write ANSYS pilot and pretension node rotations to the .cdb file.

Changes to FRANC3D from Version 7.5.0 to 7.5.1

Nov 13, 2020

1) Mapping ANSYS nodal rotations for midside nodes when upgrading linear to quadratic elements was fixed.
2) Mapping ANSYS SFE data to tetrahedral element faces was fixed; occurs when the last SFE value is 0.0 rather than a repeat of the previous value.
3) Modifications were made to improve new crack growth surfaces for cracks that twist and kink significantly.
4) Smoothing of crack front points for user-defined crack insertion was modified specifically for interior cracks with closed-loop fronts, and an option to save the smoothed points was added.
5) A bug in the fatigue crack growth extension calculations was fixed.
6) A crash associated with the file path for the ABAQUS _global.inp was fixed.
7) A crash when plotting the NasgroV4 equation/data was fixed.
8) Reading ANSYS TB BISO material data was corrected.
9) Writing ANSYS node-based TEMP table data was corrected.
10) A preliminary version of ANSYS BFBLOCK reader was added.

Changes to FRANC3D from Version 7.4.9 to 7.5.0

Sept 16, 2020

1) Bspline uniform parameterization bug fixed; it could affect crack front point fitting/smoothing.
2) Make sure output ABAQUS *STEP name is unique for each load step.

3) Output ANSYS solver type to .cdb file based on original solver type.
4) Fix table tab display of delta K value in Crack Front Plots dialog.
5) Fix bug in cycle integrations when hold time is set and K is not set constant.
6) Process ABAQUS *equation data when formatted as multiple equations under single *equation heading.
7) Clean up main window title bar file names.
8) Updates for NX NASTRAN – in particular for contact and crack face contact.

Changes to FRANC3D from Version 7.4.8 to 7.4.9

June 16, 2020

1) Clear ANSYS surf154 elements from local model after mapping pressure to solid elements.
2) Save the Normal to Surface setting when defining local crack coordinate system.
3) T-stress crack face traction term added and bug fixed.
4) Fix .frt file output for grow&merge.
5) Add option to turn off growth for specific crack fronts during grow&merge.

Changes to FRANC3D from Version 7.4.7 to 7.4.8

May 17, 2020

1) Fix kink angle computation where the “hold time” is set to FOREVER.
2) Fix y-axis format in XY plot dialog.
3) Set default local x and y vectors for command line crack insertion.
4) Fix ANSYS reader for /input data line.

Changes to FRANC3D from Version 7.4.6 to 7.4.7

Apr 14, 2020

1) Check for non-zero temperature during Save As… to set SIF computation parameters.
2) Change ANSYS volume meshing commands to bypass an ANSYS runtime error.
3) Check the Include File Path flag when writing the ABAQUS WriteDtpFile.py.
4) Fix bug when deleting load schedule events.
5) Fix bug in Fatigue Life plot when setting default plot type.
6) Reduce load event list text in Fatigue plot dialog.
7) Fix bug for SIFs along Path when exporting data for load steps with multiple substeps.
8) Fix bug in multi-XY plot – specifically for residual stress distributions.

Changes to FRANC3D from Version 7.4.5 to 7.4.6

Feb 19, 2020

1) Add support for transferring ANSYS node table data.
2) Improve search for closest point to Bezier surfaces.
3) Check for load amplitude change on a node within a *step for ABAQUS.
4) Fix bug in ABAQUS .inp reader where there is blank space in the *material type.
5) Add option to run checks on input FE mesh data when importing.
6) Fix SIF plot drop-downs for load substep when the number of substeps changes for a crack step.
7) Fix bug in XY axis plot formatting.
8) Fix multiple crack insertion command line output if rotation is not defined.
9) Fix mesh on/off check box for read and merge crack growth dialogs.
10) Add option to display crack surface geometry to crack growth dialogs.
11) Revised the fatigue cycle progress dialog to allow the user to cancel.
12) Fixed the fatigue dialog total cycles/time label.

Changes to FRANC3D from Version 7.4.4 to 7.4.5

Jan 8, 2020

1) Surface mapping of remeshed surfaces improved by passing surface normals when merging local+global model portions.
2) Add check for ANSYS uncracked doubled meshes.
3) Fix command language for ABAQUS extra contact (small sliding) and for default template radius for multiple flaw insertion.
4) Show all surface labels for extra connections for ABAQUS and ANSYS local+global connection.
5) Revise fatigue spectrum plot dialog to display reasonable x-axis values when zooming out.
6) Several bug fixes for cycle integration; specifically for the case when Kmax is at or near Kc at one or a few points along the crack front.
7) Revised stopping criteria and related messages for cycle counting, and eliminated an ‘abort’ for the case of a user-specified single cycle.
8) Ortho/perspective view option added to Preferences.

Changes to FRANC3D from Version 7.4.3 to 7.4.4

Dec 5, 2019

1) Surface normals carried forward for ABAQUS coupled/constrained surface nodes to aid in correct transfer/mapping after remeshing.
2) ANSYS post-processing macro edited for crack face contact.
3) Contact pressure for multiple load steps (or substeps) correctly applied.
4) Extra option to anchor a crack at a node so that only translation occurs.
5) Crack geometry refinement level correctly retrieved from GUI.

Changes to FRANC3D from Version 7.4.2 to 7.4.3

Nov 15, 2019

1) Adjust tolerance for Jacobian determinant when mapping boundary conditions for the case where FE units are e-6 or less.
2) Fix an issue displaying retained nodes for an edge or line of nodes.
3) Add support for ANSYS transient analyses
4) ANSYS constraint (CEINTF) MoveTol and Tol options added to dialog for local+global connections.
5) Fix InsertFileFlaw command to process modifications to flaw & template parameters from what is stored in the .crk file.
6) Fix bug in temperature conversion in fatigue life computations.
7) Fix bug when switching FE model units in fatigue life dialog.
8) Fix “stack overflow” in fatigue life dialog when counting cycles from multiple events.
9) Switch some “int” types to “long long” in fatigue life to prevent overflow.
10) Fix sleep time for MSWindows when waiting for RLM license after an analysis has finished.
11) Turned off crack front curvature correction for mode II with crack face traction (CFT) or pressure.
12) Fix bug in VCCT SIF computation with CFT or pressure.
13) Added button for plotting resolved SIFs to Advanced menu (this is not described in the documentation yet).
14) Fix equation display in the view response dialog.
15) Modified the Read Crack Growth dialog to support reading new front data for multiple crack fronts with the ability to not advance a front.
16) Add check box for crack front fitting to disable automatic updates to the extrapolation.
17) Add check box to apply crack front fit to all fronts for the case of multiple fronts.
18) Add button to local+global connection to turn on/off global set & surface labels.

Changes to FRANC3D from Version 7.4.1 to 7.4.2

Sept 23, 2019

1) Revise XY plots and equation format
2) Add check for local and global midside node ID mismatch when splitting FE data
3) Update to ABAQUS .rpt reader for element nodal stress
4) Update to ANSYS reader and postprocess script for modal analyses
5) Bug fix for ANSYS solid187 elements with missing node IDs
6) Revise path for SIF and fatigue plots when crack fronts split and/or disappear
7) Bug fix for case when closure flag is set in fatigue growth model
8) Bug fix in kink angle when Kmax and Kmin are swapped
9) Add plot tab for delta K threshold
10) Fix displayed model and result file name after Playback
11) Fix load step/schedule when adding crack face traction directly to auto-growth
12) Remove folder (path name) from external crack face traction files if same as work directory

Changes to FRANC3D from Version 7.4 to 7.4.1

Jul 30, 2019

1) Add preliminary timing output – you can request timing from the Preferences dialog
2) Fix a couple issues with ANSYS I/O; in particular, update load step for a change in omega when that is the only change in boundary conditions
3) Fix bug when computing SIFs for orthotropic materials using DC and VCCT methods
4) Fix GUI freezing after closing the Crack Front Plots dialog
5) Fix recording of lists of empty lists in session log
6) Check relative geometry patch size for multiple flaw insertion and set the refinement level if needed to make patch sizes consistent
7) Add analysis output type (full model, local model, template only) to session log

Changes to FRANC3D from Version 7.3.4 to 7.4

Jul 15, 2019

1) Add preliminary capabilities for computing elasto-plastic J-integral from ABAQUS results
2) Modified ABAQUS writeDtpFile.py script to extract data for elasto-plastic J-integral
3) Modified crack face traction (CFT) to allow user to add CFT to an existing load step and added options for setting temperature and thermal expansion properties for CFT in a new load step
4) Modified SIF XY Plot dialog to allow jpg or png export
5) Modified SIF XY Plot dialog to allow user to set axis scale and label
6) Modified SIF XY Plot to add extra legend for SIF computation options and terms
7) Color crack front edges for user-defined (bounding points and mesh) crack display
8) Process ANSYS shell (and 2D) elements along with 3D volume elements – shell elements sent to the GLOBAL model .cdb file
9) Fix some command language bugs and missing options for ANSYS – including the Python script and local+global connection settings
10) Allow for more than 99 ANSYS extra (.s##) load step files
11) Ignore unreferenced (not part of elements) nodes during crack insertion and remeshing
12) Fix GUI-related bug with temperature independent table-look-up crack growth models
13) Fix bug when writing crack growth model description text to file
14) Fix GUI-related bugs when displaying SIFs for multiple load steps and substeps
15) Add option to save .crk file during crack front merging
16) Fix crack insertion/meshing error messages
17) Fix bug finding mesh boundary facets when brick and tetrahedral elements are joined (without pyramids)
18) Process commas in quoted strings for ABSQUS inp data
19) Add preliminary capability for ANSYS static + modal combined analyses
20) Small change to point-in-region testing to improve crack front extrapolation.
21) Updated FOX library to the latest stable release
22) Updated RLM library to Version 13.
23) Updated internal license version – old license files will need to be updated.

Changes to FRANC3D from Version 7.3.3 to 7.3.4
Feb 28, 2019

1) Minor edit in fretting GUI and fretting output for found load pair.
2) Fix SERR_equiv in command line processor.
3) Fix ellipsoid void insertion using GUI.
4) Round cycles up to 1 for cases where material data might not be correct, so that positive crack growth is computed.
5) Fix kink angle for cyclic loading to make sure the weighted average is correct for high KII/KI.
6) Catch upper and lower case name variations for ABAQUS nset and elset.

Changes to FRANC3D from Version 7.3.2 to 7.3.3
Feb 14, 2019

1) Fix Edit button in multiple flaw insertion dialog.
2) Check for linear – quadratic element incompatibility in ANSYS global cdb.
3) Fix bug when reading ABAQUS crack face contact settings.
4) Surface meshing bug fix.
5) Revise check for collinear points or nodes when defining local crack coordinate system.
6) Add temperature K(elvin) units to output files.
7) Fixed (reset) default view setting in dialog panels.
8) Fixed bug when turning off / on growth of multiple crack fronts.

Changes to FRANC3D from Version 7.3.1 to 7.3.2
Jan 15, 2019

1) Bug fix when using FOREVER as the hold time in fatigue/crack growth.
2) GUI bug fix in the hold-time dialog panel on MSWindows.

Changes to FRANC3D from Version 7.3 to 7.3.1
Jan 11, 2019

1) Cycle/time integration revised – specifically to address issue where dK < dKth.
2) Updates to NASTRAN interface.
3) Bug fix in crack growth table output to file.
4) Check to make sure interior element faces are not added to crack surface contact set.

Dec 5, 2018
Changes to FRANC3D from Version 7.2 to 7.3
1) Updates and bug fixes to geometric search tree algorithm.
2) Add RBE2 data type for Nastran and fix mapping of RBE/MPC data on remeshed surfaces.
3) Add surface temperature mapping for surface temperature boundary conditions.
4) Skip output of *Dload (omega) data for Abaqus for CFT (crack face traction) load step.
5) Set correct default global coordinate system ID for Ansys output.
6) Fix various issue with output of Nastran loads and constraints.
7) Add PRCINT to Ansys output when J-intergral is turned on.
8) Add T-series element output for Abaqus.
9) Carry crack face contact settings forward for FRANC3D restarts.
10) Add code to allow user to turn on “Do not coarsen more than uncracked mesh”.
11) Add more error checking and exceptions.
12) Fix Nastran temperature setting for CFT load step.
13) Fix command line interface for crack front fitting options – specifically for multiple poly.
14) Catch several potential crashes in the load step map if the user enters incorrect data in the growth model.
15) Made geometric search tolerance more consistent for crack front fitting/extrapolation.
16) Fix issue displaying Jintegral and Tstress data in the SIF display dialog.
17) Modified the SIF path options to allow users to select the start and end of the path.
18) Modified the crack insertion dialog to define a local coordinate system and allow the crack to be positioned using the local system.
19) Add curvilinear elliptical crack to flaw library.
20) Add “from KIII” for defining the sign of K_equiv.
21) Fretting module display updates and optimizations.
22) Several display issues fixed – for example when turning on / off surface mesh.
23) Fix slow display of graphics windows in MS Windows.
24) Version number, build number and date, and documentation updated.

Aug 14, 2018
Changes to FRANC3D from Version 7.1.2 to 7.2
1) Revised bspline curve fitting routines.
2) Allow user to not retain the auto-cut-surf nodes and facets.
3) Revised nodal force mapping to check for force at midside nodes of the original mesh
4) Add material *damping to Abaqus reader.
5) Catch potential crash in Ansys reader if .cdb file is corrupted.
6) Add strain to .dtp results reader.
7) Fix bug in crack face traction load step temperature output.
8) Add options to set the sign of K_equivalent when using square-root of sum of squares.
9) Catch potential crash if original uncracked FE model is corrupted.
10) Check for highly twisted new crack surface geometry that cannot be fit to a least-squares plane.

11) Fixed bug in Walker and Newman closure models.
12) Revised crack front fitting for partial crack front growth.
13) Add fatigue crack growth plot dialog to display Kmax, Kmin, Kequiv, etc.
14) Adjust triangulation parameters for very high aspect ratio ellitptical cracks.
15) Update version number and build date and version.
16) Documentation has been updated.

May 14 2018
FRANC3D 7.1.2. fixes the following:
1) add temperature setting to CFT (crack face traction) dialog
2) modify analysis code solution when temperature set for CFT
3) fix Nastran PCH file stress reader (for CFT based on external stress file)
4) automatically adjust SIF computation settings if CFT or CFC (crack face contact) turned on
5) fix Ansys CFC pressure output macro
6) add to Abaqus reader for contact output data (for fretting)
7) add support for analysis load substeps in fretting module
8) update to crack front merging
9) minor bug fixes in SIF display and life integration display
10) status update info line added for time-consuming processes

Mar 28 2018
FRANC3D 7.1.1. fixes the following:
1) changed some recursive function calls to use heap memory to avoid crashes in MSWindows
2) add "small sliding" to Abaqus contact options
3) allow user to switch 'master' and 'slave' surfaces for Abaqus constraint and contact connections
1) between local and global model portions
4) fix the extra connection names for local and global connection
5) remove interface when importing meshes of brick elements directly connected to tet elements

Mar 28 2018
FRANC3D 7.1.0.9 version number skipped.
Mar 19 2018
FRANC3D 7.1.0.8 fixes the following:
1) add *visco support for ABAQUS
2) fix a Win7 compiler issue for 2D residual CFT
3) fix issue with add / delete of CFT
4) make sure local crack model load steps are consistent with global

Mar 11 2018
FRANC3D 7.1.0.7 fixes the following:
1) fix tie constraint and contact separation in local & global model portions
2) fix crash when using ANSYS volume meshing
3) fix dload op= type string for ABAQUS
4) fix ABAQUS odb file crack face tractions
5) fix crash in SIFs For All Fronts when analysis results are not present
6) fix crack growth when user turns off growth for a crack front
7) set better initial guess for nonlinear fretting data fitting
8) fix NASGRO4 xml input
9) fix documentation file names
10) check sign of equivalent K as a function of square root of all three modes
11) fix anisotropic toughness GUI entry

Feb 23 2018
FRANC3D 7.1.0.6 fixes the following:
1) ANSYS reader modified so load steps are not accidentally deleted from the global portion
2) SIF computation parameters no longer cleared when doing Static Analyses
3) additional numerical overflow checks in fatigue module
4) kink angle set to zero if crack extension is zero
5) check for consistent temperature dependent load schedule and growth rate model
6) fix GUI for NASGRO temperature dependent data entry

Feb 9 2018
FRANC3D 7.1.0.5 fixes:
1) searchTree modified to help identify points on the model surface - fixes some issues with crack growth
2) modified ABAQUS .fil and .dtp results reader to process more contact surface data
3) fretting module updates: (i) ABAQUS model/results, (ii) contour label set to fretting model,
4) and (iii) surface names displayed instead of "master" and "slave"
5) temperature dependent NASGRO data entry fixed
6) spectrum integration bug fix for multiple spectra
7) fatigue schedule load step multiplier read/write fixed

Jan 30 2018
FRANC3D 7.1.0.4 fixes:
1) fix crack face traction when using local + global models with no other loads
2) for Abaqus "*Include" INP= added; and "ENDSTEP" without space supported
3) material id and coordinate system id used to identify regions and boundaries
4) set defaults for substep and growth type in Fatigue dialog if unset

Jan 22 2018
FRANC3D 7.1.0.3 fixes:
1) a bug in fatigue life computation when using spectrum loading
2) allow multiple *ModelChange lines for Abaqus
3) allow for nset and elset with and without generate flag for same set for Abaqus
4) revised MSWindows startup folder
5) add tolerance when checking ends of extrapolated crack front points to make sure they are outside
6) add flag to Preferences to control amount of Ansys results output to the .dtp file
7) add flag to Preferences to increase button and text size for high resolution displays

Jan 9 2018
FRANC3D 7.1.0.2 fixes:
1) bug in the kink angle computation when using fatigue load schedules
2) Abaqus "*Boundary, submodel, step=n" data now output correctly
3) Registry settings moved to a new location in the User's home folder

Dec 15 2017
FRANC3D 7.1.0.1 fixes:
1) Transient load schedules can be defined with one load step with multiple substeps
2) Abaqus results output frequency is enabled in Preferences
3) Abaqus absolute exterior tolerance supported for *submodel command
4) Ansys variable surface pressure mapping is fixed
5) Crack growth & merging made more robust

Dec 1, 2017
Changes to FRANC3D from Version 7.0.9 to 7.1.0

1) Added Display menu, which includes View Response and Create Animation. View Response was moved from the Advanced menu. Create Animation was developed starting from the stand-alone GrowthSequence program, which is no longer distributed.

2) A Capture button was added to the main Window to provide .png or .jpg images of the current model.

3) Fatigue crack growth dialogs have been revised to allow time or cycle or combined time+cycle dependent crack growth. Multiple load steps and load substeps are supported.

4) View/Edit Growth Parameters button was added to the Fatigue menu to allow a user to edit the fatigue growth model parameters.

5) User-defined Python functions for crack growth are now supported. A Read User Extensions menu button was added to the Advanced menu.

6) The VCCT (virtual crack closure technique) was added for computing SIFs. This is intended primarily for bi-material interface cracks, which will be supported in the next release (Ver 7.2). VCCT works for isotropic and anisotropic materials.

7) Displacement Correlation SIFs for orthotropic materials is now supported.

8) A Large Rotations check box was added for the M-integral SIFs for analyses with large rigid body motions, such as rotating gears.

9) The Fretting module interface was modified to support multiple load step analyses.

10) Documentation and tutorial example files have been updated.

July 2017
Changes to FRANC3D from Version 7.0.8 to 7.0.9

1) Fix issue with ANSYS contact material ids

2) Allow multiple ANSYS pilot nodes (and associated contact surfaces).

3) Fix ABAQUS Python script to get all frames of results (first frame was missing).

4) Add support for ABAQUS analytical (revolution and cylinder) surfaces.

5) Add support for ABAQUS ROTA dload.

6) Add support for “adjust=nset” in ABAQUS contact pair.

7) Fix issues processing ANSYS surf154 elements – specifically for elements with missing or condensed nodes.

8) Ensure the ANSYS local cracked .cdb file includes the TREF value.

9) Fixed some bugs in surface meshing.

10) Allow multiple crack front group labels for user-mesh cracks.

11) Added check box to turn on/off curvature correction for M-integral SIFs (for some cases with high Mode II and negligible Mode I, the correction produced incorrect Mode II SIFs).

12) Ortho-view icon updated in Submodel dialog when “Rubberband” tool is selected.

13) Fixed ANSYS contact “keyopt” default values.

Apr 2017
Changes to FRANC3D from Version 7.0.7 to 7.0.8
1) Fixed a problem with unit conversion between FE model and crack growth data, when mixed units are used.
2) Fatigue cycles are now represented by int64 data type to allow for larger numbers.

Feb 2017
Changes to FRANC3D from Version 7.0.6 to 7.0.7
1) Changes to FE readers to check for empty first load cases. This eliminates solve time for an empty load case after crack insertion and thus removes set the resulting SIFs that are all zero.

i) NASTRAN load step added for .bdf files without a SUBCASE.
2) Changes to convert crack face traction from pressures or shear tractions to equivalent nodal forces, which simplifies the ANSYS interface considerably as SURF154 elements are not needed on the crack faces to apply shear. (See additional documentation.)
3) ABAQUS .rpt file reader edited to make somewhat more robust. Report (.rpt) files are used to apply mesh-based stress as crack face traction.
4) ABAQUS heat transfer element types read and converted to structural elements.
5) ABAQUS element type string in session log and command language interpreter fixed.
6) ABAQUS first pass reading of *Nset and *Elset data defined after *Boundary or *Dload data that references the sets.
7) ABAQUS *Submodel defined within *Assembly processed.
8) ANSYS SURF154 element pressure mapped to solid element faces for local model.
9) ANSYS load steps include time and additional boundary condition data passed through.
10) WriteCOD dialog in the Advanced menu modified to allow specification of the load step.
11) Crack growth dialog for the case of Implicit R fixed so that all user edits to the dialog are collected.
12) User-defined crack growth increment table access fixed; index into the table was off by 1.
13) Reference temperature set as the default temperature (instead of 0.0) when computing SIFs using M-integral if user turns off the “do thermal” flag.
14) A number of bug fixes have been made to the crack insertion and meshing library also.