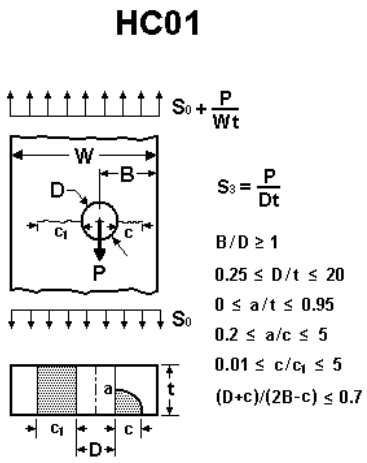
July 20, 2015

NASGRO v8.0 Release Notes

New Stress Intensity Factor Models:

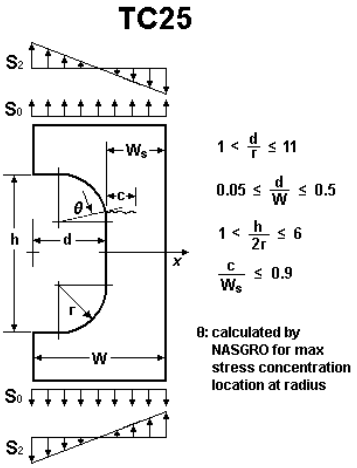
- **HC01 - Single Corner Crack and Through Crack at an Offset Hole in a Plate**

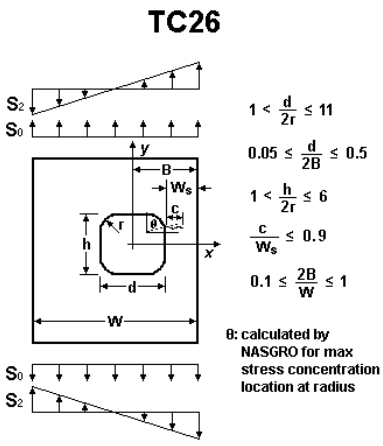
  This hybrid (corner crack and through crack) model was previously (in v7.1) only available as a transition geometry from CC17. In version 8.0, it is now also available as an independent SIF model with extended validity limits. The geometry of HC01 is shown in the figure on the right. HC01 will transition to CC15, a corner crack at a hole with a broken ligament, or to TC23, two unequal through cracks at an offset hole.



- **TC25 and TC26 – Crack at Rectangular Cutouts with Rounded Corners**

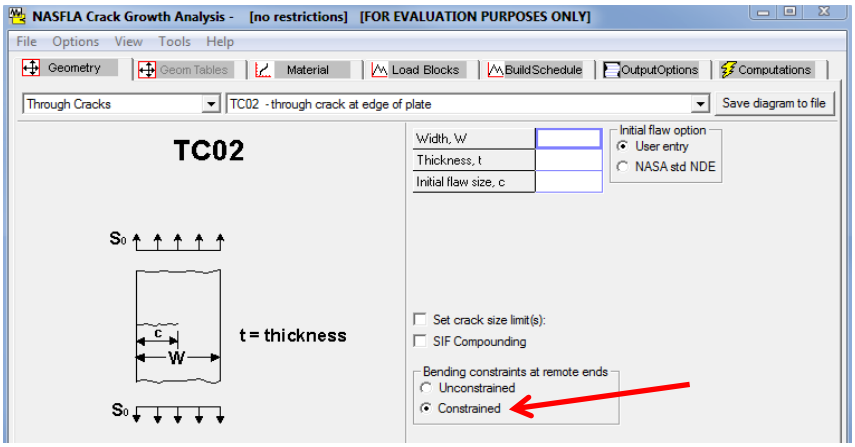
  Two new K solutions for a through crack at a rectangular cutout with rounded corners are now available. TC25 is a model for an edge rectangular cutout in a plate and TC26 models an offset internal rectangular cutout in a plate. Both models accept remote tension (S0) and in-plane bending (S2) stresses and are illustrated below. The location of the crack is a function of the geometry, loading and the resulting stress concentration where the rounded corner transitions to the flat edge surface of the rectangular notch. The location of the stress concentration and the crack is defined by the angle theta and is automatically determined by NASGRO based on the maximum tensile stress along the surface of the rounded corner. These new K solutions were derived from the univariant WF formulations previously developed for TC12 and TC17.



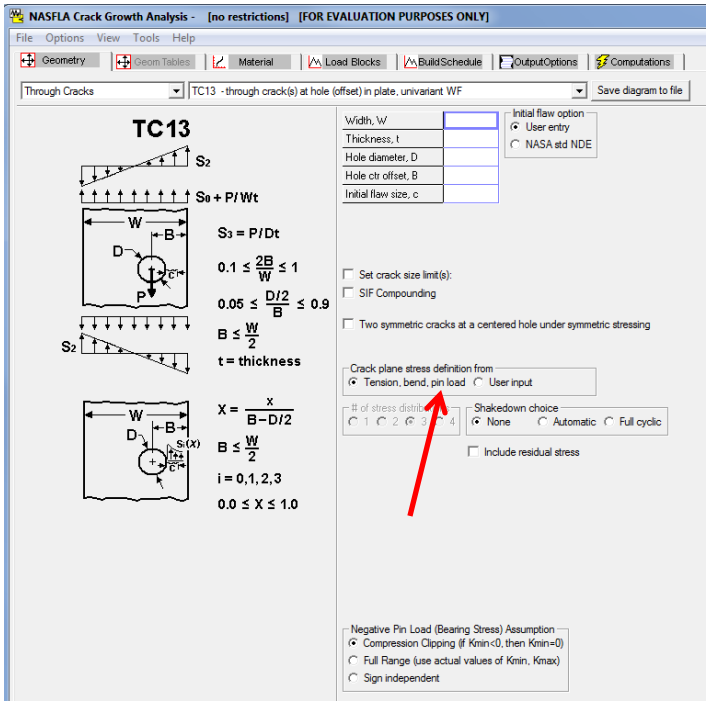


- **TC02 – Through Crack at Edge of Plate (Bending Restrained)**

  A new option was added to the existing TC02 model with boundary conditions that restrain in-plane bending at the remote end. Selecting this option will ensure uniform displacement at the remote end when a uniform tension stress is applied. When this option is selected, the two bending stresses (S1 and S2) become inactive. The default for the TC02 model is the previous unconstrained bending condition. The geometry page for TC02 with the new constrained bending option selected is shown below. This option is only available in NASSIF and NASFLA.



- **TC13 – Through Crack(s) at a Hole (Offset) in Plate with Pin Load (Univariant WF)**
  The capability to handle a pin load was added to this existing univariant WF model and can now be applied along with remote tension and bending. The model assumes a pin is inserted in the bore and has the same diameter as the hole. A concentrated point load is applied at the center of the pin. The load path from the concentrated pin load is spread and transferred through contact surfaces between the pin and the bore.

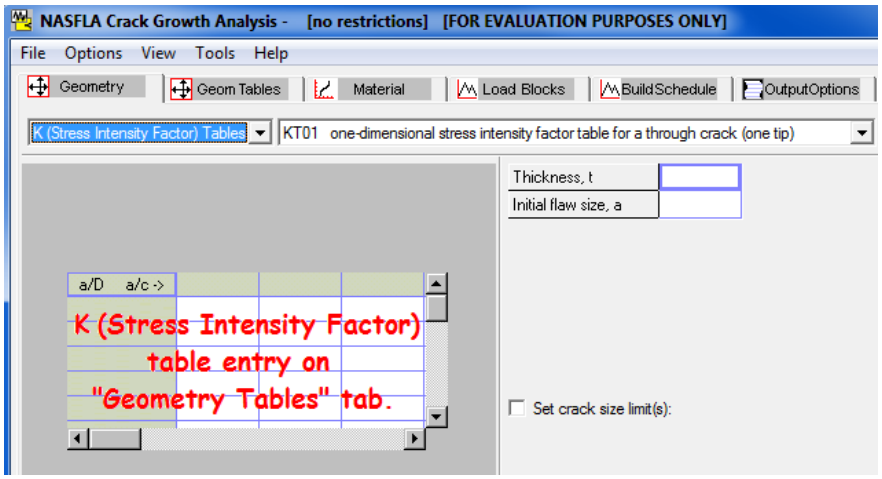


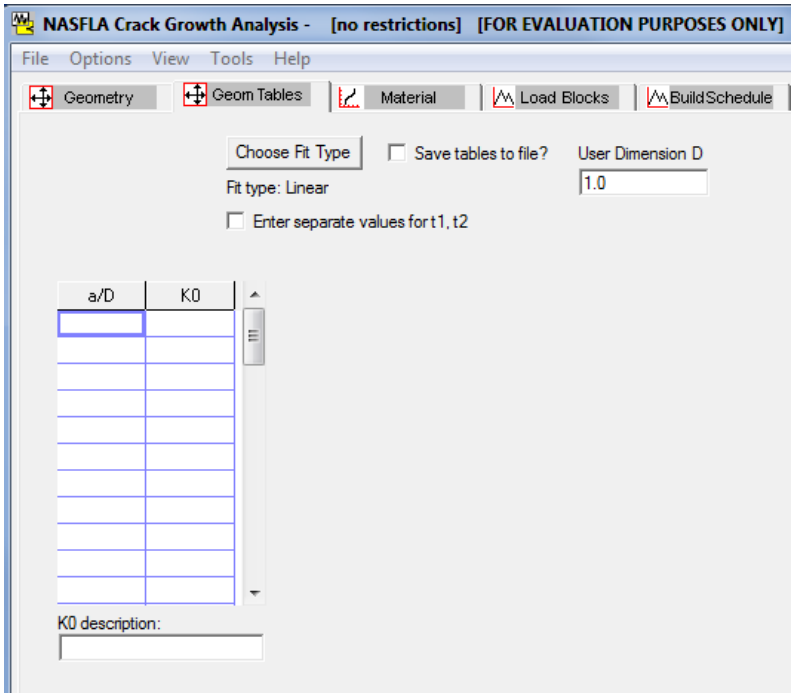
- **KTxx – Data Table Models for Input of K as a Function of Crack Size**

  A new K-table capability has been implemented to enable user input of the stress intensity factor (in *non*-normalized form) as a function of crack size. Input for the KTxx models is fuctionally analogous to the existing DTxx models that allow input of geometry (beta) factors as a function of crack size such that:

  KT01 - one-dimensional K table for a through crack (one crack tip); shown below
  KT02 - two-dimensional K table for a through crack (one crack tip)
  KT03 - two-dimensional K table for a part- through crack (two crack tips)

  Corresponding to the K-table input, a capability for the user to enter their own net-section yield tables (in *non*-normalized form) is also provided.





- **New CC16 Finite Width Correction Factors for Pin Loading**

  When crack case CC16 was first implemented in NASGRO (starting with v7.1), a new finite width correction factor was derived for remote tension loading, and this same factor was also used for pin loading. Recent work to develop new (future) pin loading capabilities for weight function crack case CC08 (to be implemented in v8.1) demonstrated that the CC16 finite width correction factors for tension loading could be non-conservative when used for pin loading. Therefore, a new CC16 finite width correction factor for pin loading was developed from the enhanced CC08 solution. This new correction factor was first implemented in v8.0 (beginning with the production release) and was subsequently backported to the bug-fix release v7.12. *Therefore, pin-loaded CC16 solutions in finite width plates will give different values in versions 7.12 and 8.0f* when compared to v7.1, v7.11, and the evaluation versions 8.0 Alpha and 8.0 Beta (which were only released to NASGRO Consortium members). *For analyses that are predominately pin loaded with "narrow" plates, predicted lives could be much less than obtained in previous versions of NASGRO.* Additional details on the development and verification of this new CC16 finite width correction factor for pin loading are provided in Appendix C of the User's Manual.

New NASFLA Features and Improvements:

- The *out2* file printing/plotting logic has been revised to correctly display results for multiple DOF transitions. The crack tip labeling of the crack models before and after transition can be inconsistent, and the applied stress components are not necessarily identical. The inconsistencies of crack-tip labeling and stress components made it difficult to print the post-transition data in the correct columns in the *out2* file. These problems were resolved using a new crack mapping mechanism to build the connection between the original crack model and the post-transition model for both crack tips and stress components.

- Continuing damage is now an option for crack case TC03. Previously, when the ligament of TC03 failed, it was assumed that the crack continued to grow on the other side of the hole using TC02 with a crack length equal to the hole diameter plus the length of the ligament. The use of this continuing damage assumption should be an active decision by the user and therefore, it is no longer the default. A checkbox has been added to the geometry page for crack case TC03 as follows:

  □ Enable Continuing Damage from TC03 to TC02

  For crack cases that will transition to TC03 first (CC02, CC04, CC07, CC16, SC11, SS11), the checkbox reads:

  □ After Transition to TC03, Enable Continuing Damage to TC02

  The default will be to have these boxes unchecked and a TC03 analysis (and any analysis that transitions to TC03) will terminate either by failure or by cracking through the ligament by default (without the continuing damage assumption to a TC02 model).

- Input of residual stresses in combination with remote tension and bending stresses has been added to crack cases TC13, CC08 and SC18.

- The Alternative Failure Criteria (failure assessment diagrams (FAD) and the two parameter failure criteria (TPFC)) have been added to SC04 and SC05 models (surface cracks in cylinders).

- It is now possible to set the limit stress settings of all blocks to those of Block 1 on the Load Blocks input screen. When multiple blocks are specified, and the limit stress box is checked, a bottoun appears to "Set all blocks' limit stress check settings and inputs to those of block 1".

- The following crack cases have been moved to the "superseded solutions" group:
  - EC01 - elliptical embedded crack in plate (use EC04 or EC05 instead)
  - CC07 - quarter elliptical corner crack at hole in plate (use CC16 instead)

  These models may still be used but are no longer recommeded. They are being retained in the "superseded solutions" group for historical and comparative purposes.

- A number of new and/or modified pop-up notes have been added to the NASFLA GUI to provide guidance and recommendations for users in regards to choices of crack cases. New pop-up notes were added for EC01, EC02, SC01, SC02, and SC12. Modifications to existing pop-up notes were made for crack cases CC07, SC30, SC31, BE02 and BE03.

- The geometry factors (Gs) used to compute net-section yield and residual strength for the weight function models have been revised and reformulated to accurately account for the integration of the applied stress distributions on the cross-section.

- The message warning the user when highly negative stress ratios are encountered has been rewritten as follows:

  ADVISORY: R < -2 was encountered
  (Does not generally invalidate analysis)

  Possible causes:
  1. Values used in load blocks
  2. Modification of R ratio in Willenborg model
  3. Compressive residual stress

  This message is programmed, as before, to be printed just once in the output file if the condition is encountered, irrespective of the actual number of occurrences during calculation.

- As discussed in Section 2.1.2 of the main NASGRO manual, multiplying ΔK by a crack-closure factor, β_R, produces more accurate crack growth predictions for semi-elliptical surface cracks and quarter-elliptical corner cracks. This β_R factor is only applied at points where the part-through crack front intersects a free surface, and it is a function of the stress ratio (refer to Eqn 2.10). In NASGRO, ΔK is multiplied by β_R for many, but not all, corner crack and surface crack models. Note that for some of the advanced crack cases such as CC09, this factor has deliberately been omitted at the present time in order to maintain conservatism until further study can be completed. A complete listing of which crack cases use or do not use the β_R factor is provided in the following table, with updates and changes made for v8.0 noted in red font. It is important to be aware that this near-surface correction is applied only in NASFLA (to ΔK for crack growth calculations) and is not used in NASSIF.

Application of Surface Crack Closure Correction Factor (β_R) to SIF

Surface crack models									
Crack case	**Crack closure factor (β_R) used**				**Crack case**	**Crack closure factor (β_R) used**			
	a-tip	**c-tip**	**a1-tip**	**c1-tip**		**a-tip**	**c-tip**	**a1-tip**	**c1-tip**
SC01	No	Yes	N.A.		SC11	**Yes**	**No**	N.A.	
SC02	No	Yes			SC12	**Yes**	**No**		
SC03	No	Yes			SC13	No	N.A.		
SC04	No	Yes			SC14	No			
SC05	No	Yes			SC17	No	Yes	N.A.	Yes
SC06	No	N.A.			SC18	**Yes**	No	**Yes**	N.A.
SC07	No				SC19	No	Yes	N.A.	Yes
SC08	No				SC26	**Yes**	No	**Yes**	N.A.
SC09	No				SC27	**Yes**	No	**Yes**	
SC10	No				SC28	**Yes**	No	**Yes**	
					SC30	No	Yes	N.A.	Yes
					SC31	No	Yes	N.A.	Yes
Corner crack models									
Crack case	**Crack closure factor (β_R) used**				**Crack case**	**Crack closure factor (β_R) used**			
	a-tip	**c-tip**	**a1-tip**	**c1-tip**		**a-tip**	**c-tip**	**a1-tip**	**c1-tip**
CC01	Yes	Yes	N.A.		CC10	Yes	Yes	N.A.	
CC02	Yes	Yes			CC11	No	No		
CC03	Yes	Yes			CC12	No	No		
CC04	Yes	Yes			CC13	No	No		
CC07	Yes	Yes			CC14	**Yes**	**Yes**		
CC08	Yes	Yes			CC15	No	No		
CC09	No	No			CC16	Yes	Yes		
					CC17	Yes	Yes	Yes	Yes
Standard specimens									
Crack case	**Crack closure factor (β_R) used**				**Crack case**	**Crack closure factor (β_R) used**			
	a-tip	**c-tip**	**a1-tip**	**c1-tip**		**a-tip**	**c-tip**	**a1-tip**	**c1-tip**
SS08	**Yes**	**No**	N.A.		SS11	Yes	Yes	N.A.	
SS09	Yes	Yes							
Boundary element solutions									
Crack case	**Crack closure factor (β_R) used**								
	a-tip	**c-tip**	**a1-tip**	**c1-tip**					
BE03	**Yes**	**Yes**	N.A.						
Hybrid crack models									
Crack case	**Crack closure factor (β_R) used**								
	a-tip	**c-tip**	**a1-tip**	**c1-tip**					
HC01	Yes	Yes	N.A.						

Color-coded solution type:

Uni-variant weight function solution

Bi-variant weight function solution

Note: Table entries in **bold red font** indicate fixes and changes made for NASGRO v8.0.

New GUI Operation Features:

- A new "View" menu has been created on the menu bar. Its contents are: "Toggle full screen mode (F5)", "Crack case list sort order", and "Tooltips" (formerly on the "Options" menu).

- The NASFLA and NASSIF GUIs may now be expanded to full-screen, allowing certain GUI controls to take advantage of the additional width, to display additional data. Full Screen mode is activated via the new "View" menu, by selecting "Toggle full screen mode" (or by pressing the "F5" shortcut key) which will switch between full screen and regular screen modes. The specific controls which are widened in Full Screen mode are:
    - NASFLA Material Tab: 2D tabular data grid
    - NASFLA Load Blocks Tab: predefined blocks grid, and manual input grid
    - NASFLA and NASSIF Computations Tab: output viewing window

  NOTE: Clicking the "box" icon in the upper right corner of the GUI will also expand the GUI to full screen (as it does any window), but does not widen any of the above mentioned NASGRO GUI controls. To increase the controls' sizes in full screen mode, you must use the menu: "View/Toggle Full Screen mode" or the F5 key.

- The new “Crack case list sort order” option allows the user to choose either an "Ascending" or "Descending" order to sort the individual crack case choices for each crack case category. A single selection will control all crack case categories. The default choice "Ascending" is a top down, lowest to highest ordering, as it was before. The "Descending" choice is a top down, highest to lowest ordering, and allows the new, higher numbered crack cases to be shown at the top of the list.

- The “Tooltips” item was moved from the “Options” menu to this new “View” menu.

- When using the Alternative Failure Criteria (FAD1, FAD3, TPFC), the NASFLA GUI can now plot the results using a new “plot failure criteria” button on the Computations screen as well as saving the Alternative Failure Criteria output to a csv file. This applies to crack cases TC11, TC12, TC15, CC11, EC02, EC05, SC04, SC05, SC17, and SC30.

Additional Features Using New NASFLA Material Database XML Format:

In NASGRO v7.1, all NASFLA material files were converted to the XML-format. For v8.0, additional capabilities have been added that take advantage of the XML database features:

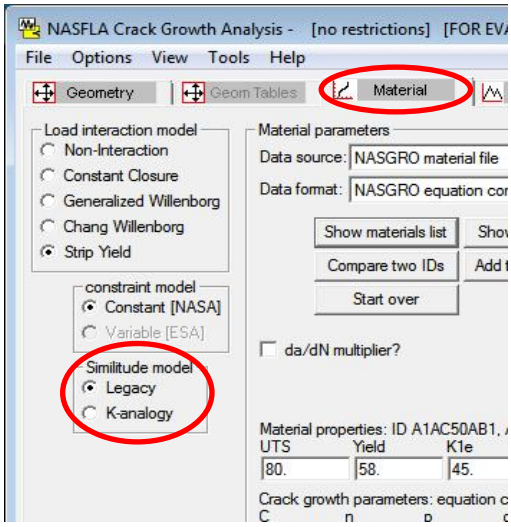
- User-named user material files are now allowed and are selectable from within the GUI and can be stored in customized locations defined by the user
- Individual user material files may now contain both US and metric unit records
- New user data can be saved to XML material file from within the NASFLA GUI
- Changes made to data up-loaded from User XML files can now be saved back to the file from within the NASFLA GUI elimimnating the need to edit the material file
- NASFLA data for NASA-provided NASGRO equation constants are now distributed in a single file (NASMF.XML) in US units replacing the previously distributed pair NASMFC.XML (US units) and NASMFM.XML (metric units)

New Rigorous K-analogy in NASGRO STRIPY Strip-Yield Module:

The NASGRO Strip Yield model (STRIPY) is based on a modified Dugdale crack model for a central through crack in an infinite plate under uniform remote tension loading. However, crack geometries in applications problem are different; they have finite component sizes, the cracks may have different shapes, and the applied stress gradients may be non-uniform. This requires a similitude function between the actual and idealized (Dugdale) models.

The STRIPY model originally employed two different similitude approaches to relate arbitrary geometries and loading conditions to the center-crack Dugdale model. One approach employs a K-analogy method: an equivalent tensile stress is applied to a center cracked infinite sheet that produces the same stress intensity factor as in the real geometry: $\sigma_{eq} = K/\sqrt{(\pi a)}$. A second approach defines the equivalent stress as the tensile stress to be applied to the real geometry that causes the same stress intensity factor in the real geometry: $\sigma_{eq} = K/f_0\sqrt{(\pi a)}$. The original STRIPY code chose this second approach for all geometries with positive f_0 values (and the first approach when f_0 was negative). However, this second approach causes difficulties for problems involving residual stress, because the geometry correction factor does not reflect the changes in the total stress intensity factor arising from residual stress contributions. Therefore, NASGRO did not previously allow the STRIPY model to be selected when residual stresses were included.

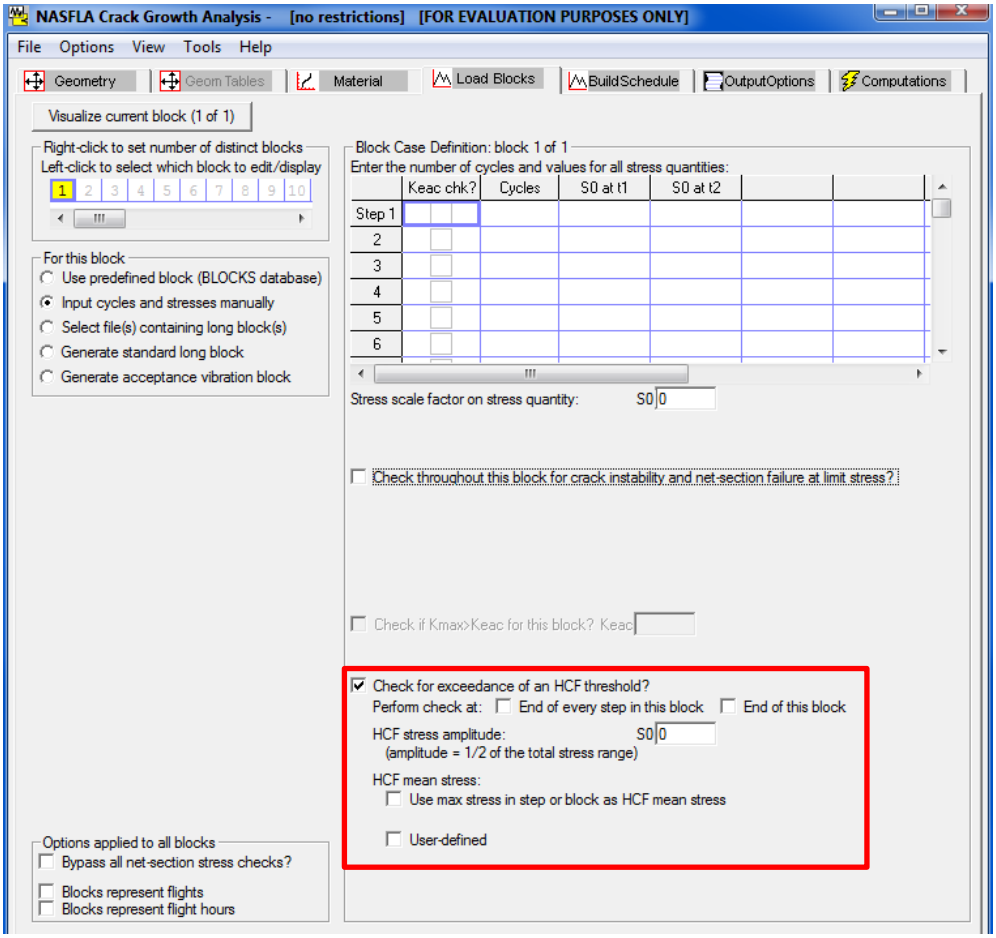
Crack closure research has now indicated that the K-analogy approach (the first approach above) is a reasonable approach to the similitude function problem. Prototype versions of STRIPY in which this approach was adopted universally have been shown in earlier research projects to give successful results for problems involving residual stress. Therefore, a new optional capability was added to the NASGRO Strip Yield model that permits the user to employ the "K-analogy" approach in all cases. If this option is chosen, then the Strip Yield can be used with residual stresses. The former ("Legacy") method remains available and is the default method for now. Users are encouraged to compare (and report) the results of the two approaches, which are likely to be similar for many simple problems.



New High Cycle Fatigue (HCF) Threshold Failure Criterion:

- A new "HCF Threshold Check" failure criterion is now available that allows the user to specify a high-cycle fatigue (HCF) stress cycle that is independent from the regular service load history. NASGRO will periodically check to see if the ΔK value calculated from this HCF stress cycle is greater than the appropriate ΔK_{th} value. If $\Delta K_{HCF} \geq \Delta K_{th}$, then failure is assumed to occur. If $\Delta K_{HCF} < \Delta K_{th}$ then nothing is assumed to happen, and regular crack growth due to the service loading is assumed to continue.

- The selection and specification of the HCF threshold check is made on the Load Blocks page (see below) and is made on a block-by-block basis, with the user having the option to set all of the inputs for all of the blocks to the Block 1 values.



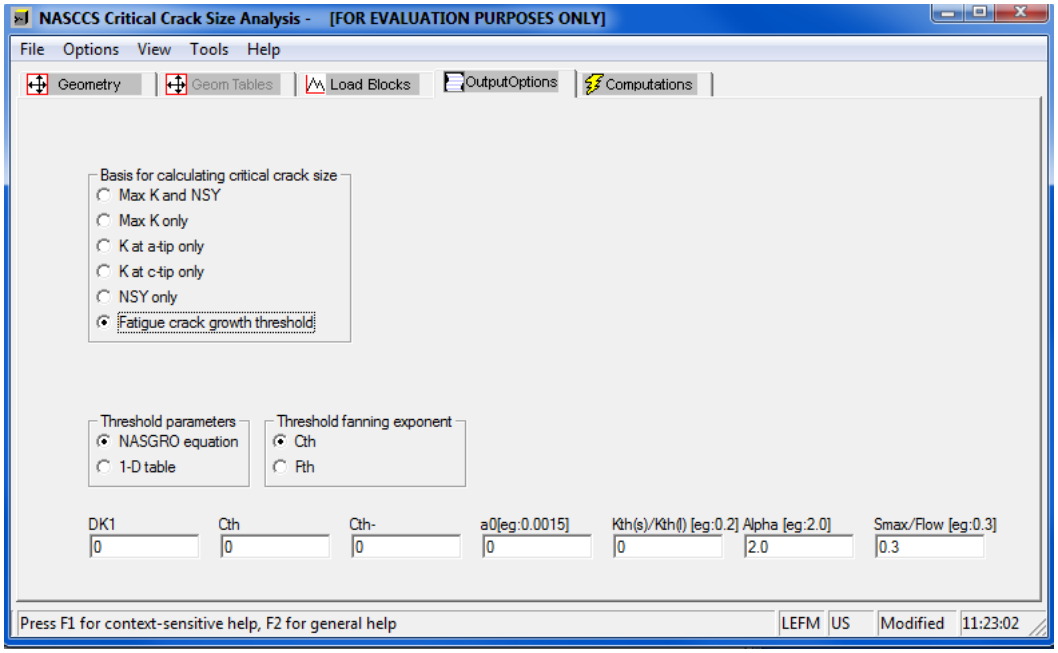
- The user is asked to specify the amplitude of the HCF stress cycle (one-half of the stress range). The mean value of the HCF stress cycle is taken as the maximum value of stress in a given step or block in the regular service load history, and so the combination of the maximum service stress and the HCF stress amplitude determines the stress ratio of the HCF cycle, R_{HCF}. This is a conservative approach that postulates the high frequency cycles occurring at the worst-case maximum stress. Alternatively, the NASGRO user is allowed to specify directly the mean stress for the HCF stress cycle. The default setting is to use the regular service history to define the mean stress. For multiple-temperature analyses, it is also necessary to choose the temperature at

which the HCF threshold check is performed. Two user options are allowed, consistent with the manner in which the HCF mean stress is input. If the HCF mean stress is determined from the maximum stress in the step or block, then the previously defined temperature at that time point will be used. If the HCF mean stress is provided directly by the user, then the user would also be asked to specify the HCF temperature directly.

Additions (NASCCS):

- An improved convergence scheme for calculation of critical crack size and threshold crack size was implemented. An additional tolerance criterion was added to the iteration process to ensure that a conservative solution was obtained such that the crack will not fail or will not propagate at the crack size obtained for the given load condition.

- Fatigue crack growth threshold crack size option was modified to include user-defined values for α_{th} and S_{max}/S_o. An option was added to allow the use of the new threshold fanning approach that employs F_{th}. The default remains C_{th}.



Additions (NASMAT):

The ability to fit threshold data using an expression based on F_{th}, a new exponent to model fanning behavior, has been implemented in NASMAT. This expression is given by

$$\Delta K_{th} = \Delta K_{1f}^{*} \left[\frac{1-R}{1-f[R]}\right]^{1+F_{th}^{p}}, \qquad R \geq 0$$

$$\Delta K_{th} = \Delta K_{1f}^{*} \left[\frac{1-R}{1-f[R]}\right]^{1+F_{th}^{m}} \frac{1}{(1-A_0)^{F_{th}^{p}-F_{th}^{m}}}, \qquad R < 0$$

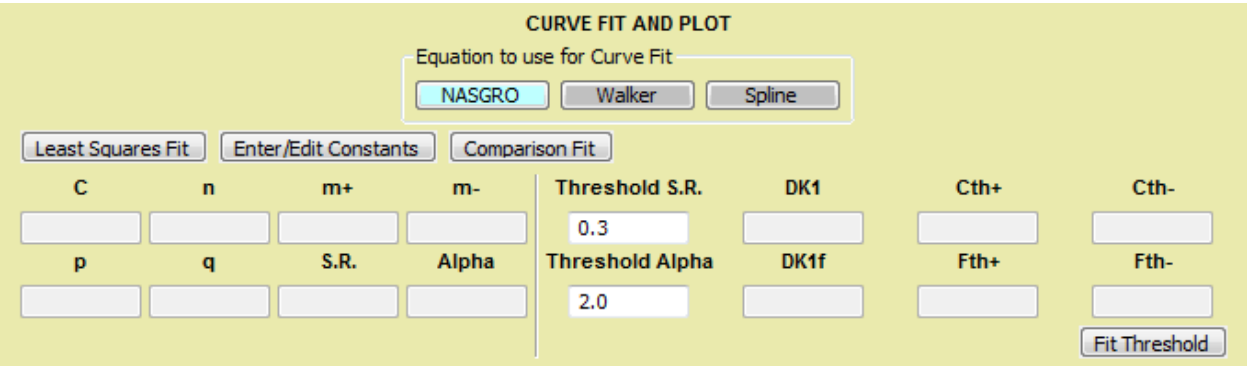
in which

$$\Delta K_{1f}^{*} = \Delta K_{1f} \left[\frac{a}{a+a_0}\right]^{1/2}$$

where F_{th}^{p} and F_{th}^{m} refer to values of the exponent F_{th} for positive and negative values of the stress ratio, R.

Plots of threshold data fits using the new expression based on F_{th} are shown juxtaposed against data entered by the user and against fits based on C_{th}, the older fanning exponent. The reason the new expression has been introduced is its physically congruent property of satisfying the condition $\lim_{R\to 1} \frac{\partial \Delta K_{th}}{\partial R} = 0$ for all levels of fanning, as readily evident in the plots generated, a property that the older expression (based on C_{th}) lacked.

The method for performing threshold fits on the Curvefit/Plot tab has been overhauled. The 'Calculate' button has been removed, and the 'Fit Dk0, Dk1, Cth' button has been renamed 'Fit Threshold'. Fitting threshold values now calculates Dk1, Cth+, Cth-, Dk1f, Fth+ and Fth-. These values can be plotted, as well as saved to NASFLA. NASMAT now fits and plots da/dN data using both options (Cth and Fth) for modeling threshold fanning. The NASMAT curve fitting screen has been reconfigured to display both the C_{th} and F_{th} threshold fit parameters as shown below:



Additions, Changes, Fixes and New Items by NASGRO Module from v8.0 Alpha

November 25, 2004

Category	Applicable NASGRO Module										Description
	NASGRO Main	Config Control	NASFLA	NASSIF	NASCCS	NASGLS	NASMAT	NASBEM	NASFORM	Users Manual	
Change			X								Turned off the transition from TC23 single crack to TC19.
Change			X								Changes were made to overhaul the printing of NASGRO Equation constants in the out1 file for both mono- and multi-temperature analysis
Change										X	Added or updated bitmaps for the following crack cases: TC13, TC18, TC25, TC26, CC08, CC09, CC14, SC27, and HC01
Change										X	Updated description for crack-closure factor, BetaR, in the main manual and in Appendix C
Change										X	Appendix C: Added description for crack case TC24
Change			X	X							Crack cases CC14, SC27, TC18: The lower limit in the following expressions have been changed from 0 to 0.05: for straight-edge slot configurations: 0.05 <= (d+r)/B <= 0.75; for elliptical hole configurations: 0.05 <= e1/B <= 0.75.
Change			X	X	X	X	X	X	X		All GUIs no longer contain individual lists of changes for the new NASGRO version and instead simply link to the overall release notes document.
Fix			X								Output file was fixed to display the correct values of K1c, Ak and Bk when doing multi-temperature analysis, instead of values of zero previously erroneously shown.
Fix			X								Selecting or unselecting the "Bypass all net-section stress checks" checkbox did not cause NASFLA to prompt the user to save the input file.
Fix			X								Repetitive end of output when selecting items in “select details to show” window. This anomalous output was caused by continuously resetting a flag for NSY check leading to repetitive checks and messages.
Fix										X	Appendix Q: Corrected ID on page 7, changing ID from "P#EMD8LA4" to "P3EMD8LA4".
Fix					X						When attempting to use the "Plot Stress" option in SC04 an erroneous Fortran error "5" pop-up would be generated due to a malformed batchfile.
Fix										X	Appendix B was updated to include information on the new v7.1 crack models. The description on the NSY description for SC17 and SC19 had been updated. The same description applies to crack models SC30 and SC31. A new section describing the theoretical approach used in TC24 crack model was also included.
Fix			X	X	X	X					Crack case CC09: corrected upper limit for a/t expression in bitmap images from 0.9 to 0.95.
Fix			X								Erroneous display in output file of text: "Manual data input" was corrected to make the text appear only if the material data was actually entered manually. For material data read from file, the name of the source file is now included in the output file.
Fix										X	Missing factor DK1f* was inserted in Equations 2.11c and 2.11d.
Fix			X								STRIPY was corrected to have results for the following crack cases be sensitive to chosen value of alpha: CC01, CC09, CC12, CC13, CC14, CC15, & CC16
Fix			X								Crack case CC16: fixed the crashing problem in calculation of post-transition compounding for CC16-TC03-TC02 transition when transitioning to TC02 if post-transition compounding is enabled in the original crack model (CC16).
Fix								X			Arc segments would not use the chosen start point after altering the drawing canvas scale.
Fix								X			When selecting the midpoint of an arc segment, the midpoint was not properly 'snapped' to a valid mid-point. This resulted in erroneous arcs, or arcs whose end points were shifted from the user-selected end-point.
Fix			X								When utilizing the "Do parameter analyses..." option on the computation tab, the output data would not properly be viewed or plotted from the computations tab.
Fix								X			The labels under the toolbar icons have been altered for clarity.
Fix								X			Corrected multiple issues wherein changing the snap value when drawing segments would lead to shifting start points, incorrect end points, incorrectly calculated mid-points, or invalid grid entries.
Fix				X							TC23 would not run due to an incorrectly formatted batchfile.
Fix				X							Conflict between NASSIF GUI, manual and code for CC16 with zero crack depth. This scenario occurred when correction factors (or normalized stress intensity factors) were to be determined. The zero crack depth in the denominator resulted in a numerical error. This bug was resolved by a change in the internal interpolation.
Fix			X								Saving the plot of a basic material fit to text file would save incorrect values da/dN values.
Fix								X			Creating line segments of a length equal to or less than the snap value would not calculate a mid-point nor add it to the points grid.
Fix			X								When switching between DT01 and DT02 crack cases via the "New Project" menu option, the DT01 geometry grid was not properly clearing from the geometry tab.
Fix			X	X	X	X					Fixed a general input problem, i.e. if a single hyphen ("-") was entered in the input box for a string, it would alter the later data input, and result in code crashing or erroneous results.
Fix			X								On the Computations tab, selecting multiple items under 'Show Selected Details' would not always properly retain the choices made between runs. Previously selected, but then removed, items would reappear when running the problem again.
Fix			X								The "Save Changes" dialog should only appear when changes have been made and the input has passed preliminary validation. Previously, NASFLA was showing the "Save changes" dialog for inputs that had been changed but had errors that prevented execution.
Fix										X	Appendix U: Table corrected to show SIFs for crack case TC11 for "c" and "c1" tips

Additions, Changes, Fixes and New Items by NASGRO Module from v8.0 Alpha

November 25, 2004

	Applicable NASGRO Module										
Category	**NASGRO Main**	**Config Control**	**NASFLA**	**NASSIF**	**NASCCS**	**NASGLS**	**NASMAT**	**NASBEM**	**NASFORM**	**Users Manual**	**Description**
Fix			X								Switching between tabular data and 'new data' on the materials tab did not properly remove prevously selected material data.
Fix										X	Appendix X: Updated using the new filenames for the FAD and TPFC output
Fix			X	X							Removed duplication of problem description field in the input files.
Fix			X	X							The K compounding tables were not explicilty ending edit mode when the tab was changed. This could lead to the runtime validation checks erroneously reporting that a K compounding table had an inconsistent or incorrect number of entries.
Fix			X								Attempting to select CC17 with the calculation mode set to indirect calculation of initial flaw size or stress scale factor multiplier now correctly gives an error message, as CC17 is not a valid case for those option.
Fix			X	X	X	X					Crack case CC08: corrected lower limit for the "X" coordinate for normalized stress expression in bitmap images from 0.1 to 0.0.
Fix			X		X						The Plot Table Data on the Geometry tab for DT01, DT02 and DT03 would not plot G factors unless the user had first plotted the Beta factors. Moreover, the fit type for these three cases could not be chosen independently of Beta factors, despite the ability of the dll to process seperate fit types.
Fix		X	X								The configuration control options for (1) hiding a crack growth model and (2) locking the "Cth-" material parameter were ineffective in the NASFLA GUI.
Fix		X									The text control for "Set Bk=0" was incorrectly placed, superimposed over the unlocked/locked/hidden label for Bk instead of immediately next to it. The result of this was the "locked/unlocked/hidden" label appeared to be the contents of the text control, appearing to users as if there was no field indicating whether Bk was set to 0 on the main configuration control panel.
Fix			X				X				NASMAT dataset G2CF12AB01A removed: was listed as containing 17-4 H1050 plate data but in actuality was a duplicate of a 17-7 TH1050 dataset. NASFLA ID G2CF13AB1, the only fit based on that NASMAT dataset (and based only on that dataset), was also removed
Fix			X								Univariant stress files and the residual stress grid were not being properly validated prior to computation.
Fix			X								The "Set Bk=0" configuration control option was not being properly utilized, setting Bk to "zero" in the material tab as opposed to "0". If the field was further locked or hidden, this prevented successful exceution as the problem could not be corrected by the user.
Fix						X					Crack cases DT01, DT02, DT03: Only the S0 data table was displayed on the GeomTables tab, regardless of the number of stress distributions selected on the Geometry tab.
Fix			X								When a computation fails the GUI validation steps and aborts prior to computation, in addition to the validation error an error message regarding the 'out1' file is erroneously generated.
Fix			X	X	X						Crack case SC18: A GUI input error was not being issued for geometry values: crack offset B not equal to half width W, combined with "two symmetric cracks at a centered hole under symmetric stressing" checked.
Fix			X							X	NASGRO Manual Appendix V amended to clarify that it applies to the Willenborg load interaction models
New		X									The buttons "Load Existing Profile", Save To Profile", and "Manual", formerly located at the bottom of the Configuration Control GUI window, have been removed, and their functionality added to the new Menu bar: "File", "Help". The File menu contains various profile file functions : "Create new profile", "Save to profile", and "Load existing profile". The Help menu contains a link to the Configuration Control manual, and general "About" text.
New		X									A new feature "Add/Edit Manager Notes" button has been added to the bottom of theConfiguration Control GUI, which allows a manager to enter text that is saved to the NASFLA control file and can be displayed in the NASFLA GUI using the GUI's new "View / Manager Notes" menu. Additionally, there is an option in the CC GUI to also force this text to be shown immediately on startup of the NASFLA GUI, to ensure that their target users will see it.
New			X								The content of the XML material file "File description" tag, which is currently displayed on-screen on the Material tab, will now also be written to the DLL-created "out1" output file.
New			X	X	X	X					Several menu keyboard shortcuts for many existing menu items have been created: File: "New project (Ctrl+N)", "Load project… (Ctrl+L)", "Save input (Ctrl+S)", "Save input as… (Ctrl+A)"; View: "Toggle full screen mode (F5)" [new]; Help: "NASGRO manual (Ctrl+M)", "NASGRO website (Ctrl+W)", "NASGRO Release Notes (Ctrl+R)".

Additions, Changes, Fixes and New Items by NASGRO Module from v8.0 Beta

March 26, 2015

	Applicable NASGRO Module										
Category	**NASGRO Main**	**Config Control**	**NASFLA**	**NASSIF**	**NASCCS**	**NASGLS**	**NASMAT**	**NASBEM**	**NASFORM**	**Users Manual**	**Description**
Addition			X								The spectrum file editing functions of Truncation and Clipping have been expanded and now include the removal of flat cycles and consecutive increasing/decreasing cycle sequences from the edited file, a feature which the other spectrum editing file already have.
Addition			X								Crack cases TC11, TC12, TC15, CC11, EC02, EC05, SC04, SC05, SC17, SC30: For analyses using the Option 1 FAD, Option 3 FAD, and Newman TPFC failure assement criteria, Failure Assessment Diagrams (FAD) can now be plotted in the NASFLA GUI and the calculated ouptut data saved to CSV files.
Addition			X								Crack cases SC04, SC05: Alternative failure criteria (FAD) capability has been added.
Addition							X				Added optional ability to fit and plot da/dN data using Fth, the new threshhold fanning approach. Fitting and viewing the Cth-based fit is still available.
Change										X	Updated text describing SC08, SC13 & SC14 in Appendix C
Change			X	X	X					X	Updated SC08 figure in GUIs and manual; specifications have been changed to note application to aerospace-quality fasteners.
Change										X	Updated text describing applicable thread types for SC08, SC13 & SC14 in Appendix C.
Change										X	Clarified language in section 2.1.3 (Threshold Stress Intensity Factor Range) regarding the small crack correction factor, and its lower bound.
Change			X		X					X	The applications of surface crack closure correction factors to selected SIF models were updated as shown in the attached table. This table was aslo revised in Appendix C of the Manual. The crack cases affected were SC11, SC12, SC18, SC26, SC27, SC28, CC14 and SS08.
Change			X	X	X	X					Crack cases TC13, TC14, TC17, TC18, TC19, CC08, CC13, CC14, CC15, EC02, EC04, EC05, SC17, SC18, SC19, SC26, SC27, SC28, SC30, SC31: The radiobox selection of "# of stress distributions" is now reset to "1" whenever a user changes the selection in the radiobox "Crack plane stress definition from" from the initial default selection to the weight function selection of Tabular or User Input, to more clearly indicate that for weight function stress definitions, any number of user-entered stress distributions can be used, from 1 to 4.
Change			X								Since a user mateiral file can now contain records of any units type, when a user material record is read and manually changed data is saved back to the user file, the NASFLA GUI will now save that record in the units type of the record when it was originally read. Previously, the record would get saved back to file in the units type that the GUI was currently set to display.
Change			X								Crack cases TC11, TC12, TC15, CC11, EC02, EC05, SC04, SC05, SC17, SC30: The failure criteria options, shown on the NASFLA GUI Material tab for specific crack cases only, will now be shown only after a material selection has been made. Formerly, these controls were shown immediately on the selection of an applicable crack case, allowing user entries to be made in these fileds, which could get overwritten by material file record values if no material had been selected yet. Showing these controls after a material selection has been made prevents this possible overwrite, so that no user-entered data is lost or needs to be re-entered.
Change			X	X	X	X				X	Crack case TC08: Maximim flaw size total angle has been increased from 180 to 270 degrees and minimum cylinder length speccified. Figures have been updated in GUIs and Manual.
Fix								X			When placing special hole boundaries with bearing stress in NASBEM, the pin load vector was not drawn on the canvas nor recorded in the special hole boundary information table.
Fix								X			Points placed on the drawing canvas in NASBEM appeared to be improperly offset from the reference hashmarks, due to a rounding error in calculating the placement of the reference marks.
Fix								X			After adding a boundary condition in NASBEM, previously placed cracks would disappear from the drawing canvas until the 'Replot' button was utilized.
Fix										X	Corrected the labelling errors in the SC07 figure in Appendix B.
Fix				X							NASSIF TC11 crack tip output columns mislabled. The inconsistency only occurred when correction factors were to be determined. Correct crack tip labeling has been applied.
Fix					X						Corrected an error in crack size limit setting for crack case TC23 in critical crack size calculation.
Fix			X								Fixed the problem which led to negative value of stress scale factor multilpier in NASFLA inverse calculation when the express mode is enabled.
Fix			X								Material data from a previously selected ID would remain on the material tab after selecting 'new data'.
Fix			X								On the material tab, the Ramberg-Osgood cell for Poisson ratio would be correctly greyed out, yet still be editable, after selecting FAD Option 3.
Fix			X								On the material tab, the 'mean E' input box and the Ramberg-Osgood stress-strain grid's 'Elastic modulus' input cells should show the same value when FAD options 1 and 3 are selected. Updating the Ramberg-Osgood cell did not properly update the 'mean E' input box.
Fix			X								On the material tab, the 'min yield' values for FAD options 1 and 3 were not properly synced in cases where only one option was selected.
Fix			X								Fixed an error in geometry parameter setting for HC01-to-CC15 transition.
Fix								X			When placing edge cracks in NASBEM, the ordinary boundary information table was not properly updated with the crack ID nor tabulating the number of edge cracks along that boundary.

Additions, Changes, Fixes and New Items by NASGRO Module from v8.0 Beta

March 26, 2015

	Applicable NASGRO Module										
Category	**NASGRO Main**	**Config Control**	**NASFLA**	**NASSIF**	**NASCCS**	**NASGLS**	**NASMAT**	**NASBEM**	**NASFORM**	**Users Manual**	**Description**
Fix					X	X					Attempting to plot DT tables in NASCCS and NASGLS would generate pop-ups labeled 'Fortran 5'.
Fix			X	X							Inconsistencies were found in TC13 in comparison with TC03 when pin load was applied. A bug was found when to scale the stress variations resulting from pin loading. The applied fix ensures the comparison between TC13 and TC03 subjected to pin load to be consistent.
Fix								X			When placing cracks in NASBEM, new cracks would be generated as new segments on a previously existing crack, rather than as a new, independent crack.
Fix			X								Disabled SC04-to-TC07 transition if tabular stressing is applied on SC04.
Fix			X								Zero values for material parameters Ak and Bk were being flagged incorrectly as errors and were not allowed for analysis.
Fix								X			When placing internal cracks, NASBEM did not correctly identify which zone the crack was in, nor correctly tabulate the number of cracks per zone in the Zone Information Grid.
Fix			X								A plot image was not generated for the Compare Two IDs function on the NASFLA GUI Material tab.
Fix				X	X						EC05's a/c geometry limits were not being properly validated by the GUI.
Fix			X	X							Fixed the following problems for crack cases SC11 and SC12: 1) The beta-R correction in ΔK calculation was applied to the interior tip (c-tip) by mistake; 2) The failure check of the degraded crack cases was performed on a-tip erroneously; 3) The compounding factors were calculated from the incorrect compounding tables, i.e. the compounding facotrs at a-tip were calculated from the compounding tables for c-tip, and the compounding factors at c-tip were calculated from the compounding tables for a-tip.
Fix			X	X							SIFBAT analysis with centered TC11 crack gave different results between Windows and Linux platforms. It was identified that the differences were resulting from numerical accuracy with different platforms. As a result, different numbers of stress points were defined as well preintegrated SIFs. A revision only to centered TC11 crack is applied where linearly interpolated stress points are used for preintegration instead of those from Hermite polynomials.
Fix			X	X							CC09 SIF analysis failed to complete the computation. The DLL included with NASGRO release can not reproduce the error. It was identified to be a cross-compiler issue. The pitfall was from the nearly stepwise gradient which resulted in numerical issue among different compilers.
Fix			X								Crack casesTC03, CC02, CC04, CC07, CC16, SC11: An overlap of screen controls occurred between the SIF Compounding option and Continuing Damage option checkboxes.
Fix			X	X							The geometry check for CC15 was not properly validating the that (B+D/2)/W could not exceed 0.75.
Fix			X								When editing a spectrum file and choosing to use the edited file for analysis, the scale factors previously entered on the NASFLA GUI Load Blocks tab were incorrectly reset to zero, requiring the user to re-enter these values.
Fix			X								FAD properties were not initiated in strip yield load interaction model when determining constraint transition properties.
Fix			X	X							For SC28, the geometry check for "(B+D/2)/W < 0.75" was not being properly performed.
Fix			X								Tabular da/dN data could not be successfully plotted due to an error in creating the batchfile.
Fix			X								TC11 stress tables were not validated to ensure they covered the full range from -1 to 1
Fix			X								The comparison plot for two IDs from the user material file was printing unwanted filepaths in both the title and the two-column notes section of the generated plot image.
Fix			X								Enabling FASTRAN analysis option for the release NASGRO DLL. The revised DLL can be invoked without GUI through the usage of NASGRO batch mode.
Fix								X			When placing a point on the drawing canvas, NASBEM was not properly valiging the new point. This led to cases where NASBEM would erroneously alter the position of a previously defined point, rather than create a new point.
Fix			X								When changing units, the materials list dialog on the materials tab would not retain previously selected material choices.
Fix			X	X	X						CC16: Corrected a geometry parameter check error, i.e. W/D ≥ 2 for both single crack and two symmetric cracks. The problem has been fixed by checking B/D ≥ 1 for single crack and W/D ≥ 2 for two symmetric cracks.
Fix			X								NASFLA GUI would crash when choosing "User material file" as the data source, clicking the "Compare Two IDs" button, then attempting to choose a material ID from the dialog. The crash occurred only when there was no material ID selected on the main Material tab.
Fix			X								SC31 and SC19 normalized coordinate (x/W) was echoed incorrectly in OUT1 file. The echoed output was in reference to a different coordinate system used internally in fracture mechanics modules. Fixed to now list x/W fom zero to 1.0.
Fix			X	X							SC31 and SC19 problem with inconsistent crack growth at c- and c1-tips. Incorrect swapping of SIFs with crack tips in SC31/SC19 fracture mechanics module was identified when the offset B is less than W/2. This bug only affected the SIF solution when a tabulated (bivariant) stress gradient was input; i.e., not from remote tension/bends or polynomial stresses.

Additions, Changes, Fixes and New Items by NASGRO Module for v8.0 Final

July 20, 2015

	Applicable NASGRO Module										
Category	**NASGRO Main**	**Config Control**	**NASFLA**	**NASSIF**	**NASCCS**	**NASGLS**	**NASMAT**	**NASBEM**	**NASFORM**	**Users Manual**	**Description**
Addition			X								Transition from CC10 to TC13 was added.
Change			X								The use of yield stress in the Alternative Failure criteria was clarified in the documentaion (Appendix X) and the code was checked to ensure that it consistently implements the FITNET methods. The platic limit load criterion uses the average yield stress from the NASFLA database. For FAD Options 1 and 3, a minimum yield strength is used and is a required input by the user. For the TPFC, the average yield stress from the NASFLA database is used.
Change		X									The Confiugration Control GUI can now be installed and run in any location, and no longer contains the requirement to be installed in the regular program files installation path.
Change		X	X								All references to "Manager Notes" have been changed to "Manager Notes to Users" to more clearly convey this feature's purpose.
Change			X	X	X	X					For most GUI data plots, dashed gray lines have been added for both axes, and the legend now contains a black outline, for added readability.
Change			X	X	X	X					After an analysis has been completed, the "View Ouput" window on the Computations tab will now automatically scroll to the bottom, so that the "Results" section at the bottom is immediately shown. Previously, this window display remained at the top, and users needed to manually scroll to the bottom to see the Results statements.
Change							X				Optimized fitting for negative R of Rpeak & corresponding Upper Bound for Fth-based threshold, making it consistent with Cth-based fitting, especially for the case when negative R data are unavailable, correcting some errors related to Fth fitting in 8.0 beta.
Change										X	Updated Section 6.2 to reflect changes made to threshold fitting in NASMAT, and to Section 6.4 on files created by NASMAT.
Change										X	A fuller description of the small crack correction factor and the intrinsic crack size a0 has been provided on p14.
Fix							X				Corrected non-functional check-box for weighting each set of constant-R data equally when curve-fitting to obtain C and n.
Fix							X				When using the Fit and Plot checkboxes on the "Choose Plot/Fit Data" tab did not always process all boxes marked 'plot' when displaying plotfiles.
Fix			X								The user was not prompted to resave the input file after loading an input file with material parameter values differing from database values and choosing "use material database values".
Fix			X								The material selection dialog for 'Compare Two ID's' was missing the footer note that refers to Appendix Q.
Fix			X	X	X						Crack cases SC19, SC31: Created dynamic bitmap displays to show the following stress definition details separately, all of which were previously shown on a single image, which was confusing: tension/bends stress, polynomial stress, user-defined stress with and without alternative 2-D input type.
Fix			X								When using the Walker equation on the Materials Tab, the right click menus options for "Erase" and "Insert/Delete" for the material constants grid did not work.
Fix										X	Corrected assorted errors in: a) Equation 2.27, b) Text in p25 identifying the stress ratio used in the Walker equation when non-interaction model is invoked, c) Table 10, d) Maximum possible number of blocks in p86, d) location of output files in p112, and e) extant NASMAT unit systems in p131.
Fix			X	X	X	X					Crack Cases TC11, TC12, TC17,TC18, TC19, CC13,CC14,CC15,EC02,EC05,SC17,SC26,SC27,SC28, SC30: Stress files were not fully validated (inputs & upper and lower bounds) for these cases.
Fix			X	X							Crack Case SC09: Calculations used the incorrect bolt sizes when working in metric units.
Fix			X	X							Crack Case SC13 : Calculations used the incorrect metric bolt sizes and the r/D geometry check was not validating correctly for metric units. The r/D range upper bound has been corrected from "1.0" to "0.1".
Fix			X								Multi-temperature material data was not being properly validated at run-time, flagging a0 of '0' and Cth of '0' as incorrect.
Fix		X	X								Load interaction models marked as 'hidden' in Configuration Control were being displayed in NASFLA after selecting a material on the material tab.
Fix				X							Plotting solutions for TC04 correction factors leading to Fortran errors. The error was traced back to an incorrect variable declaration resulting from recent implementation.
Fix		X									The setting for "Cth value used in analysis' was not being respected by NASFLA, which continued to default to '0 throughout'.
Fix			X								During the transition from SC19 to CC09, the columns containing the values of B and W-B were interchanged in OUT2 files. The discrpancy was resulting from different offset designations (B) in GUI and DLL utilized internally. The DLL has been updated to use the consistent offset definition.
Fix				X							Anomalous behavior in EC02 NASSIF results with a/c as crack sizes get larger. An incorrect conditional check was found that converting the centered EC to a transitioned geometry. The fix has been updated not to perform such an invalid transition. In addition a tolerance of 0.0001 has been included in the solution limit check for the a/Bt ratio.

Additions, Changes, Fixes and New Items by NASGRO Module for v8.0 Final

July 20, 2015

	Applicable NASGRO Module										
Category	**NASGRO Main**	**Config Control**	**NASFLA**	**NASSIF**	**NASCCS**	**NASGLS**	**NASMAT**	**NASBEM**	**NASFORM**	**Users Manual**	**Description**
Fix			X								Fixed the following two problems for SC11 and SC12: 1) For SC11 and SC12: The failure check on the degraded crack cases (TC03 for SC11, and TC04 for SC12) was applied on the erroneous crack tip. 2) For SC11: the reference data tables for the geometry factor calculation of the degraded crack case (TC03) was not created, so the K values obtained for the failure check on the degraded crack case (TC03) were always zero.
Fix		X									Loading a profile into Configuration Control resulted in multiple parameters being incorrect, depending on the configuration of the saved profile.
Fix			X								The DLL generated using Intel Fortran resulting in run-time error for NASFLA analysis when linked with GUI. The pit fall was a result of closed Fortran default input and output file units: 5 and 6.
Fix			X								Material Q3LB23AB1 was nor properly loading all references due to a malformed line in the materials database.
Fix			X	X	X						Fixed a coding error in calculation of net section stress for SC18 under remote tension and bending.
Fix			X								NASFLA was not making a case-insensitive check for already existing material IDs when saving material to the material file.
Fix						X					Crack Case TC13: The computation for TC13 with "tension, bend, pin load" selected resulted in an error.
Fix					X	X					Crack Case TC13: The geometry tab for TC13 with "tension, bend, pin load" selected erroneously shows the grid cells for user entered.stress
Fix					X						Crack Case TC13: On the OutputOptions tab, the stess quantities are incorrectly labeled when "Tension, bend, pin load" is selected.
Fix						X					Crack Case TC13: On the Load Blocks tab the stress quantities for remote stresses are incorrectly labeled.
Fix					X						Crack Case TC13: On the OutputOptions tab, the Alpha and Smax/Flow parameters are being erroneously displayed upon load or creation of a crack case.
Fix			X	X	X	X					Crack Case SC09, SC13: When loading the crack case from file with metric units selcted, the bolt sizes are listed in US units
Fix			X								Corrected formatting error in output file which caused stars to be printed in the "To" column under Block Number, when the number exceeded 4 digits.
Fix			X								1-D tabular material data with exactly 25 rows was preventing an anlysis from running. The error has been corrected, and additionally, this table has been expanded from 50 to 100 rows.
Fix			X								Fixed an output problem for HC01, i.e. the SIF geometry factors were overwritten before saving to the out2 file.
Fix			X		X						Crack Case KT01,KT02,KT03: After selecting a KT case and then switching to a non-KT case, the Geometry tab would incorrectly display the 'separate plots for t1,t2' checkbox. Furthermore, plotting from the Geometry tab could result in plot labels being incorrect.
Fix			X								When changing the negative pin load option the user is not prompted to save the input file.
Fix			X								Under certain conditions, selecting "NASGRO material file: multiple temperatures" as the Data Source on the Materials tab would cause the GUI to become unresponsive.