August 15, 2022

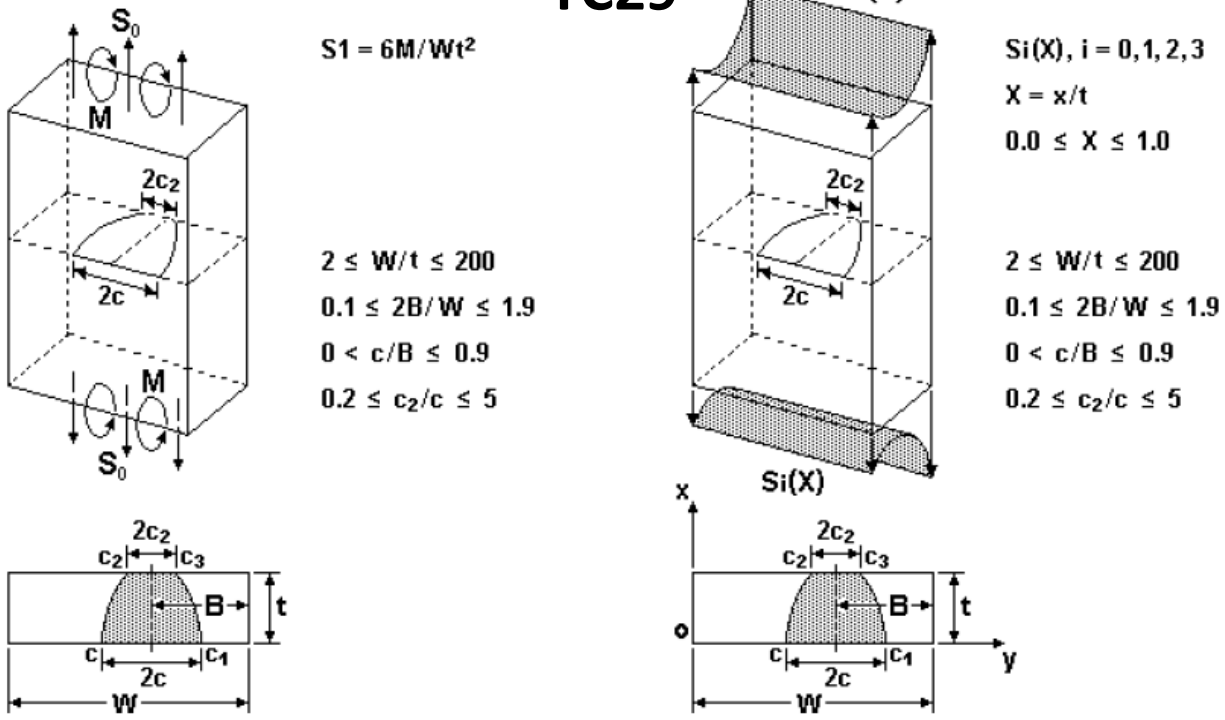
NASGRO v10.1 Release Notes

New and Improved Stress Intensity Factor (SIF) Models

- **New Model for a Curved Through Crack in a Finite Width Plate (TC29):**

Crack case TC29 is a new solution for a curved offset through crack in a finite width plate. It is analogous to the straight crack front in TC11, with additional capabilities for out-of-plane bending, though without the incorporation of in-plane bending. The part-elliptical crack front allows for two separate surface crack tips: "c" on the front face and "c_2" on the back face of the plate. The plate can be loaded by remote tension/bending stress or by univariant stress gradient along the plate thickness on the crack plane. TC29 supports curved crack fronts that model the physical shape of cracks under out-of-plane bending. Additional detail on the development of this new model is contained in Appendix C of the Reference Manual.

TC29



(a) Remote Tension/Bend **(b) Univariant Crack Plane Stress**

- **New Weight Function Solutions for Surface and Through Cracks at Holes (SC37, SC38, and TC43):**

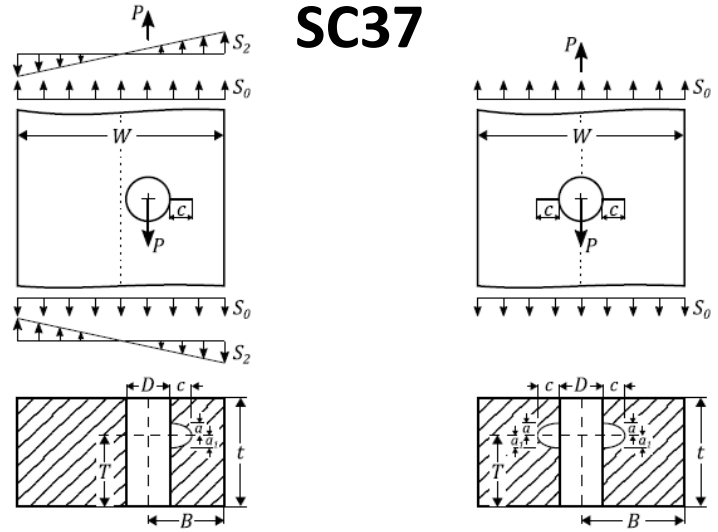
Three new crack cases (SC37, SC38, and TC43) have been developed as improvements over previous cracked hole models (SC18, SC29 and TC13), with improved accuracy and larger calibration matrices. We recommend that users employ them as their default SIF solutions for these geometries in all new analyses. NASGRO continues to support the older SIF solutions for legacy purposes. Additional detail on the development of these new models is contained in Appendix C of the Reference Manual.

Crack case SC37 is a univariant weight function solution for a semi-elliptical surface crack growing from a hole surface of a finite width plate. *SC37 is an improved version of SC18 with better accuracy relative to SIF solutions extracted from high-fidelity FEAs*. SC37 supports univariant stresses as service loadings and as residual stresses. SC37 also supports remote loadings S0, S2, and S3 as shown to the right. The following two sub-configurations are available for use:

1. A single crack growing on the short ligament side of the offset hole
2. Twin cracks growing symmetrically from the opposite sides of the centered hole under symmetric loading

The geometry limits for this case vary depending on the crack configuration selected and are displayed in the GUI and summarized in Appendix C. These limits match the earlier limits for SC37.

SC37



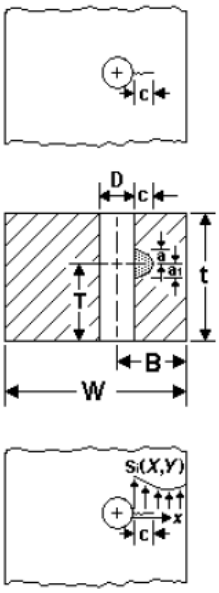
(a) crack on short ligament remote loading

(b) two symmetric cracks remote loading

(c) crack on short ligament crack plane loading

(d) two symmetric cracks crack plane loading

Crack case SC38 is a bivariant weight function solution for a single semi-elliptical surface crack growing at a hole surface of a finite width plate. The crack is located on the short ligament side of the hole. The crack model shares the same geometric configuration as SC37 with a single crack option. However, this model provides a capability to define bivariant stress variation across the crack plane. *SC38 is an improved version of SC29 with better accuracy relative to SIF solutions extracted from high-fidelity FEAs*. SC38 has the same geometric limits as SC29.



SC38

$0.25 \le D/t \le 2$

$0.5 \le a/c \le 5$

$0.1 \le B/W \le 0.5$

$0 \le c/(B-D/2) \le 0.8$

$0.05 \le 2T/t \le 1.95$

$a/\min(T, t-T) \le 0.95$

$X = x/(B-D/2)$

$Y = y/t$

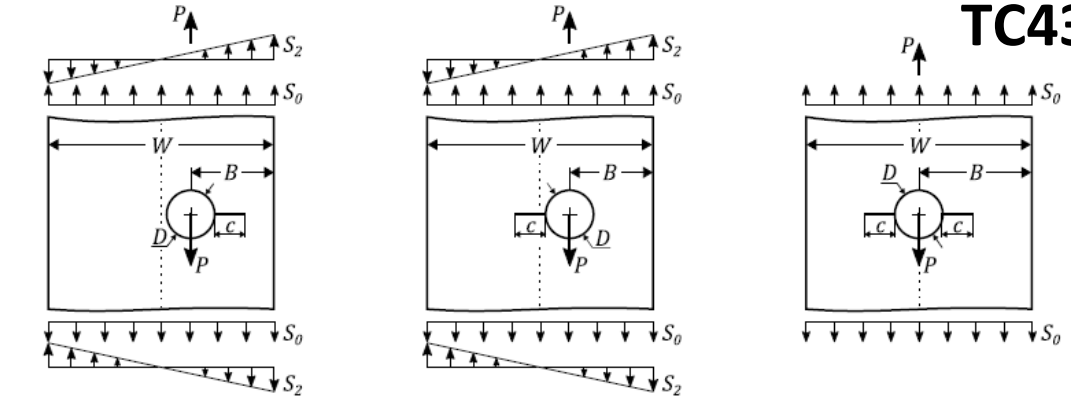
$0.0 \le X \le 1.0$

$0.0 \le Y \le 1.0$

$i = 0,1,2,3$

Crack case TC43 is a weight function solution for one or two through cracks at an off-center hole in a finite width plate with a general nonlinear stress distribution. *TC43 is an improved version of TC13 with better accuracy relative to SIF solutions extrated from high-fidelity FEAs*. One of the following subconfigurations can be selected: 1. The crack on the short ligament side of an offset hole, 2. The crack on the long ligament side of an offset hole, or 3. Two symmetric cracks from a centered hole. The geometry limits for this case vary depending on the crack configuration selected and are displayed in the GUI and summarized in Appendix C. These geometry limits match the geometry limits for TC13. TC43 supports remote loadings, user-defined stresses, and residual stresses.

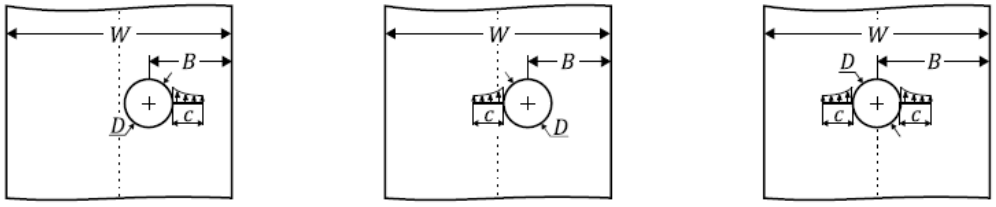
TC43



(a) crack on short ligament remote loading

(b) crack on long ligament remote loading

(c) two symmetric cracks remote loading



(d) crack on short ligament crack plane loading

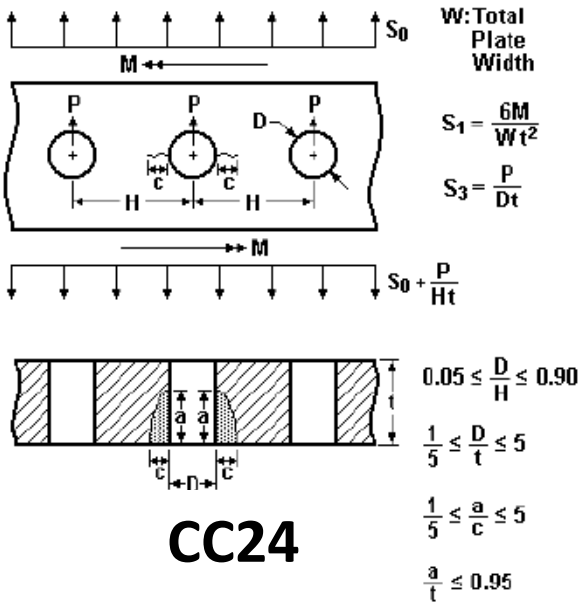
(e) crack on long ligament crack plane loading

(f) two symmetric cracks crack plane loading

- **Expansion of Corner Cracks in Row of Holes Model for Two Cracks at One Hole (CC24):**

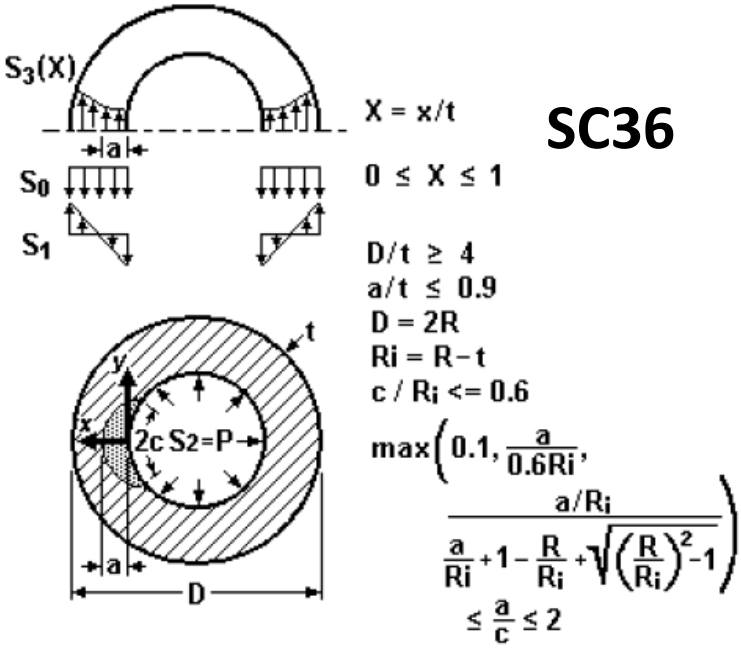
Previously, crack case CC24 only supported two identical quarter-elliptical corner cracks located at all holes in a row of holes. In NASGRO v10.1, we have expanded CC24 to support two equal corner cracks located at a single hole in a row of holes. There a toggle in CC24 to switch between the different geometric configurations. The original solution remains the default.

The geometric limits are largely consistent in both crack case configurations, though the crack length may be larger if only one hole is cracked. CC24 continues to support S0, S1, and S3 loading remotely, and it transitions to TC05 if the crack tip breaks through the thickness.



- **Addition of Surface Crack in Hollow Sphere Model for Internal Crack (SC36):**

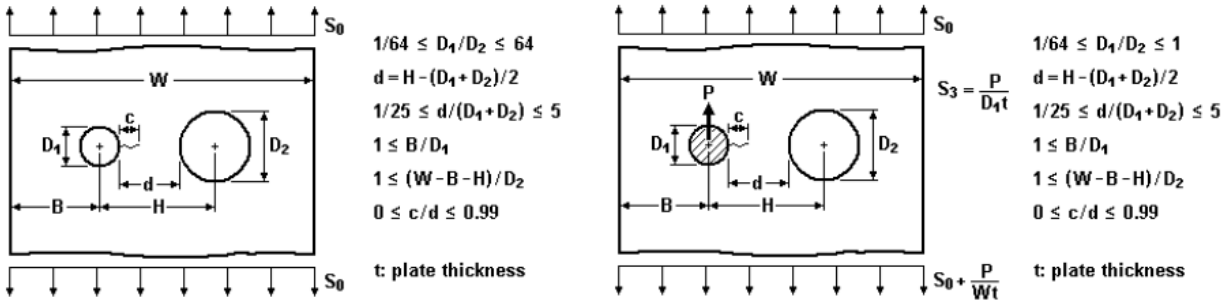
Crack case SC36 is a weight function solution for a surface crack in a hollow sphere. Previously, the crack could only be located on the external surface. A new solution has now been added to SC36 that supports a surface crack on the internal spherical surface. The user can select an internal or external crack location via a radio button on the SC36 GUI. The internal crack is now the default option. SC36 supports the loadings and geometries shown on the right. It also supports axisymmetric stresses in the sphere as service loadings and residual stresses.



Additional detail on the development of this new model is contained in Appendix C of the Reference Manual.

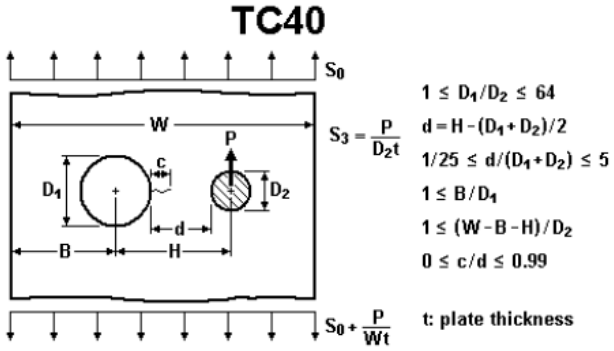
- **Expansion of TC40 for a Through Crack Between Two Unequal Holes in Wide Plate to Include Finite Width and Hole Offset:**

TC40 features a straight through crack located between two unequal diameter holes in a plate. NASGRO v10.0 introduced this solution for infinite width plates. In NASGRO v10.1, TC40 now supports finite width plates and hole offset. There are three geometric options available shown below that support different pinned configurations. For the pin-loaded cases (b) and (c), the pin is always in the smaller diameter hole. TC40 always supports remote uniform loading. TC40 also continues to support infinite width plates. To activate the infinite plate solution, the user should set W > 100*(D1+D2+d) and center the two-hole system in the plate. The resulting SIF will match the SIF from v10.0 for an infinite width plate.



(a) No pin

(b) Pin in cracked hole



(c) Pin in uncracked hole

- **Expanded Solution Limits and Other SIF Model Improvements:**

  - ***Expansion of TC28 for thinner plates with end bending restraint***

TC28 is a part-elliptical through-crack model in a finite width plate, with the option of either restrained or unrestrained in-plane bending. The geometric limits of TC28 have been extended to support thinner plates and smaller cracks for models with restrained bending. The maximum width-to-thickness ratio has increased from 20 to 100, making the geometric limits identical for restrained and unrestrained bending.

  - ***Expansion of TC35 solution limits when bending is restrained***

The crack case TC35 represents an edge through-thickness crack in a plate with a single symmetric step change in thickness. Bending can be either restrained or unrestrained. Previously, there were different geometric limits for the restrained and unrestrained cases, with the unrestrained case allowing wider variation in both relative widths and thickness. The restrained configuration has now been updated to allow for the same limits as the unrestrained configuration, as shown below.

$1 \le t_2/t_1 \le 10$ $\quad\quad$ $0.05 \le W_2/W_1 \le 10$

$0 \le c/W \le 0.9$ $\quad\quad$ $0.005 \le t_1/W_1 \le 1$

  - ***Revision of TC08 geometry limits***

TC08 represents a planar circumferential through crack in a thin walled hollow cylinder. Previously, the GUI showed the minimum cylinder length for solution validity, but did not verify that requirement was met prior to running the solution. The program has been updated to verify the length. A check for the minimum radius/thickness ratio has also been implemented to prevent potentially nonconservative results with $R/t < 10$. In both cases, the analysis allows the user to proceed with the warning, if desired for comparison to legacy analyses.

  - ***Updated transition route for CC26***

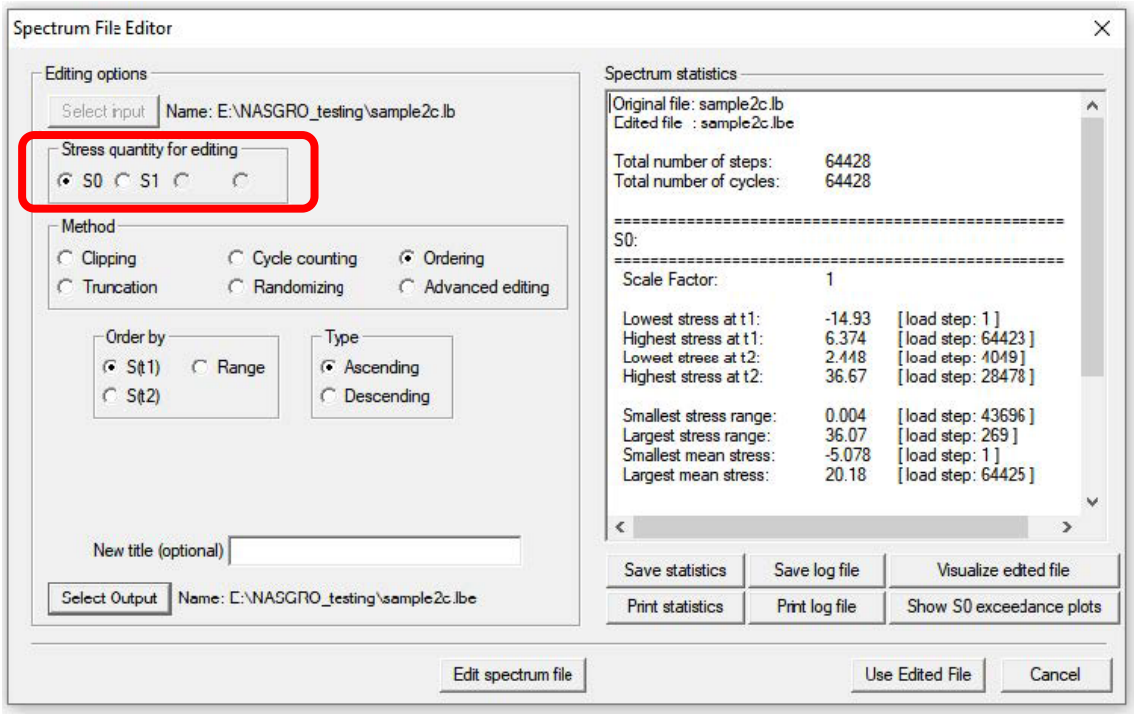
CC26 is a bivariant weight function solution for a quarter-elliptical corner crack at hole offset in a plate. It is analogous to CC10, and it was introduced in NASGRO v10.0 as a more accurate solution than CC10. Previously, it transitioned from CC26 to TC13 if the crack depth broke through the thickness. In NASGRO v10.1, it has been modified to transition to TC43 to take advantage of the increased solution accuracy of TC43 vs. TC13. Note that for legacy purposes, CC10 still transitions to TC13.

  - ***Option for SC30 to transition to a curved through crack***

NASFLA v10.1 introduces a new capability for SC30 (an offset semi-elliptical surface crack in a plate) to transition to a straight through crack (TC11 or TC12) or to a curved through crack (TC28 or TC29). Users may toggle between these transition routes on the Geometry tab of NASFLA. By default, NASFLA sets the toggle to the straight through crack fronts that have historically been the only option.

Expansion of Spectrum Editing Capability

In previous NASGRO versions, spectrum editing (for example, clipping or truncation) could only be performed using the S0 value in the load spectrum. Starting with NASGRO 10.1, users can select which one of the stress quantities (as available based on the selected crack case) they wish to use for editing. This is especially helpful for crack cases such as lug geometries, for which only S3 loading is available. Selection of the stress quantity is done in the pop-up Spectrum Editing window.



Graphical User Interface and Output File Improvements

- The graphical user interfaces (GUIs) for a number of the NASGRO modules have been upgraded to be more flexible and dynamic. Previous work in recent versions included converting GUIs to be fully dynamic layouts, adjusting controls for different screen resolutions, enabling scrolling of the entire GUI pane, and retaining the proper layout when changing the GUI size. This update continued that progress by updating many of the various pop-up dialogs to accommodate different screen and/or font sizes. Implementation of additional dynamic dialogs is planned for future releases.

- Previous NASFLA versions printed an advisory message in the OUT1 file and the GUI output window whenever R < -2. However, the advisory message provided little useful information, and users had no real alternatives. The message sometimes prompted unnecessary concern among novice users and was probably ignored by veteran users. Therefore, beginning with NASGRO 10.1, this advisory message will no longer be printed. We have revised Section 2.1.2 of the NASGRO Reference Manual to provide additional

explanation of the analysis approach used for R < -2. We have reviewed this approach and confirmed that it is reasonable and sufficient.

- At the end of the "Final Results" section of the NASFLA output and the OUT1 file, a line has been added to show both the "Initial crack model" and the "Final crack model." The crack model descriptions have also been updated for consistency with those in Appendix C of the manual. This additional output provides a convenient indication if transition occurred during the analysis or not.

Material Nomenclature Updates

- P3EA13AB1: The ID and the product form/orientation/environment description for this material indicate that the fit is based on both L-T and T-L data. However, in actuality it is based only on L-T data. The description has been corrected, and the ID has been changed to P3EA11AB1 to comply with NASGRO ID naming conventions (where "11" indicates L-T data only, and "13" indicates both L-T and T-L data).
    - The NASFLA GUI will intercept ID P3EA13AB1 when loaded from an input file and instead load the replacement ID P3EA11AB1. The GUI will automatically resave the input file with the replacement ID, and the option to save the original input file under a different name is presented to the user.
- M7QC22AD1 and M7QC25AD1: Some time ago the industry group maintaining aluminum alloy temper designations changed the T736xx temper designation to T74xx for alloys 7050 and 7175. This was already reflected in NASGRO for alloy 7050 but not for 7175. This is now corrected by showing both T74 and T736 in the alloy and heat treatment descriptions for all M7QC entries, as well as in the specific material descriptions shown in the material parameter value section for entries M7QC22AD1 and M7QC25AD1. This is consistent with how 7050 is displayed in NASGRO.

Documentation Improvements

The Reference Manual has undergone significant improvements in recent years, and those improvements continue. In addition to adding or updating the Appendix C sections for each of the crack cases described above to reflect new features and capabilities, the following changes were made for this version:

- Section 2.2.3 (Choosing the Crack Geometry) was revised and reorganized to provide up-to-date description of the crack geometries that are currently available in NASGRO.
- Section 2.2.7.4 (Setting the Limit Stress Checks) was revised to clarify differences between input of limit stresses and scale factors for each of the stress quantities, depending on the crack case in use. GUI labels were modified accordingly.

- Sections 2.2.10 and 2.2.11 (NASFLA Outputs and Computations) were expanded. These sections now provide a detailed summary of the different features and options that are currently available in Output Options and Computations tabs of NASFLA.

- Section 6 of the Main Reference Manual documenting the use of NASMAT has been fully rewritten. It now contains significantly more detail on the various features, step-by-step instructions for viewing, entering, and fitting new data, and descriptions of each of the library, user, and program files used by the module. The new Section 6.4 provides guidelines for obtaining fracture toughness and fatigue crack growth rate data in order to fully characterize a material for inclusion in the NASMAT database and fitting of the NASGRO equation.

- Appendix B has been expanded to include new sections for TC29, CC24, and SC36. TC40 net section stress formulations were also updated for the finite width plate solutions.

- Appendix C has been expanded to include descriptions for the new crack cases TC29, TC43, SC36, SC37, and SC38. Also, the descriptions for TC08, TC28, TC29, TC35, TC40, and CC24 were updated to include additional details and solution verifications.

- Appendix D was overhauled and ported over to the new LaTeX documentation system. The new document is reorganized into a case-by-case structure. Each section starts with a summary of overall transition capabilities of the crack case. The summary page includes a case-specific transition diagram designed to give a quick visual of the downstream transition paths and show what other cases can transition into the current crack geometry. The remainder of the crack section provides all forward transition capabilities that it supports. This new document implements hyperlinked TOC and text, wherever possible, so the reader can conveniently navigate through the sections of interest. The new pdf bookmarks can be used to quickly jump to a crack section of interest. Finally, while the document was being overhauled, a number of new crack cases were added to the document, including TC24, TC29, TC33, TC34, TC37, TC39, CC18, CC24, CC26, CC29, CC30, SC30, SC31, SC37, and SC38. Additional details were also added for CC01, CC08, and CC11.

- Appendix N is a completely new appendix that provides the detailed mathematical background and algorithms used by NASMAT in fitting the NASGRO and Walker equations to fatigue crack growth rate data. In addition, the mathematics of the fitting process used to model the dependence of ΔK_{th} on R, and to convert the fanning parameters (C_{th} and F_{th}) are described. Details are also provided on the equations used to calculate the parameters (A_k and B_k) used to model the thickness dependence on toughness.

- Appendix Q was updated with the material nomenclature changes detailed above.

NASGRO v10.1a Changes and Fixes by NASGRO Module

January 19, 2022

	Applicable NASGRO Module											
Category	**NASGRO Main**	**Config Control**	**NASFLA**	**NASSIF**	**NASCCS**	**NASGLS**	**NASFAD**	**NASMAT**	**NASBEM**	**NASFORM**	**Users Manual**	**Description**
Addition								X				Derived the formulas, checked out, and verified the Fortran code for the following NASMAT submodules: 1) curve fitting da/dN vs. ΔK & R, 2) curve fitting ΔKth vs. R, 3) Cth-to-Fth comversion and Fth-to-Cth conversion, 4) Determining Ak and Bk for fracture toughness (Kc) calculation.
Addition								X				Converted the NASMAT Fortran code from Lahey to Intel Fortran. Established the Fortran debug environment, tested the code, and verified the results.
Change			X	X	X							Implemented the soft geometry limits to the DLL for crack case TC08 and for SC05-to-TC08 transition.
Change								X				The crack growth rate spline fit option was removed from NASMAT.
Fix			X									Material M7GJ11AB1 not showing references properly due to NASFLA not properly parsing empty data for some header values.
Fix			X									In the NASFLA GUI, when viewing output data after an analysis in the "view output window" on the Computations tab, the header columns that identify the data were not properly aligned with the coumns of data below them.
Fix			X									Output option "Every 2000th step" not functioning correctly. This option was found not being implemented in the DLL.
Fix				X								TC35 solution fluctuates with increasing crack size when subjected to restrained bend. Two issues were identified related to smoothing algorithm for interpolation and a typo in one of the polynomials for reference solutions.
Fix			X									Determination of Kc value for TC28 not consistent with the through thickness tip definition. Kc was defined incorrectly for 2D partial through cracks.
Fix			X	X	X							Crack Case TC28: When bending is restrained, crack plane stress definition was improperly changed to "tension" rather than remaining "tension, bend."
Fix			X									Final crack size labels swapped for SC30 output. The inconsistency could be found in OUT1 files as well as in GUI's Output Windows based on information extracted from OUT1.
Fix			X									Missing header lines in new HCFOUT files when comparing "old" and "new" output with enabled HCF option. The missing header data lines included the version ID, crack case ID, and description for tabulated columns.
Fix			X									SC30/SC31: When the post-transition geometry is set to "Curved through crack," an erroneous FAD line was being written to the batch file blocking computation, and the option to "Bypass all net-section stress checks" was missing from the Load Blocks tab.
Fix					X							Crack case SC34: The Plot stresses button on the Geometry tab would not plot all of the defined stresses for the case.
Fix			X	X	X	X	X					Input files not able to be opened under some foreign language versions of Windows due to unicode error.
Fix			X									Transition from SC29 to CC10 at the a1-tip appearing earlier than the documented solution limit. This bug triggered several subsequent revisions relating to (1) typo found in checks against solution limits, (2) incomplete implementation for local failure, (3) stress mapping during transition and (4) reset of crack size limits from crack transition.
Fix			X	X	X	X	X					Some crack cases could not be selected in the Crack Case Library dialog window. Additionally, after successfully selcting a crack case, when then selecting a different crack case from the dialog but then choosing "No" in the confirmation window, the Geometry tab would be inadvertently cleared.
Fix				X								Crack Case HC01: Upon reloading HC01 inputs, the output format option "plot solutions" would be inadvertenly enabled.
Fix			X	X	X							Crack Case TC28: Error message for W/t limits stated incorrect lower bound.
Fix			X									Inconsistent initial crack shape aspect ratio printed in OUT2 file with SC26 and SC27 crack cases.
Fix			X									SC27 NASFLA computation terminated without explicit final result shown at the end of OUT1 file. Though users might find the exit information at the end of SCREEN.OUT file, the reported crack length was also not in agreement with the crack length in OUT2 file. Further investigation showed that the error output was not directed to the binary database such as to be included in OUT1 file.
Fix						X						Crack case TC28: An extraneous flag was being written to the batch file for analyses using residual stress polynomial grids, preventing the run.
Fix			X									Crack Case TC28: GUI output would erroneously duplicate NDE flags under analysis mode "calculate intiital flaw size, given target life."
Fix				X								OPS plotting anomaly observed when using the "Plot stresses" option in Geometry GUI tab. This issue affected on-screen display and not the analysis result.
Fix				X								Net section stress incorrect for TC11 symmetric case. The reference area was calculated incorrectly in accordance with the force computation.
Fix				X								Column for Sn value with S2 component in tabulated Net Section Stress for CC15 contains all zeros. The cause was inconsistent recast of stress scale factor in net section routine.

NASGRO v10.1b Additions, Changes, and Fixes by NASGRO Module

April 15, 2022

	Applicable NASGRO Module											
Category	**NASGRO Main**	**Config Control**	**NASFLA**	**NASSIF**	**NASCCS**	**NASGLS**	**NASFAD**	**NASMAT**	**NASBEM**	**NASFORM**	**Users Manual**	**Description**
Addition								X			X	Created Appendix N -- NASMAT mathmatical background and algorithms
Addition			X	X	X							Implemented net section stress solution for TC29, CC24 (two cracks at one hole), and SC36 (internal crack)
Addition			X									Printed "Initial crack model" and "Final crack model" to the .out1 file for NASFLA direct fatigue life analysis
Change			X	X	X	X	X					Corrected the crack model labels printed to the .out1 file to make them identical to those in Appendix C for all crack models
Change			X									Removed the Advisory message printed to the .out1 file for R < -2
Change		X	X	X	X		X					Crack case SC36: updated description from "univariant WF" to "WF solution"
Change			X	X	X							Crack case TC28: Revised check on limits, from "0 < c/W <= 0.9" to "0 < max(c,c2)/W <= 0.9 Crack case TC29: Revised check on limits, from "0 < c/B <= 0.9" to "0 < max(c2,c)/B <= 0.9
Change			X									Material ID P3EA13AB1 was replaced with ID P3EA11AB1, and older input files run with the old ID will be automatically resaved with the new ID
Change			X	X	X							SC13: Fixed the bug that prevented users from entering r_f value greater than 1 when D is manually entered by selecting "Other" option from the Bolt diameter list
Change			X	X	X	X	X					Added a space between "Tension" and "bend" in the Crack plane stress definition radiobox selections, for many weight function solutions
Fix								X				When entering toughness data in metric units, NASMAT was not properly converting the values when saving
Fix			X									Setting p=0 or q=0 made the temperature interpolation for FCG properties fail. The interpolation was revised to treat these specific scenarios exclusively such as not to result in NaN (not a number) encountered in arithmetic transformation.
Fix			X									Implicit NASFLA for initial flaw size failed with SC30 transitioning into "curved through crack" subjected to polynomial stress. A memory management scheme during transition was found at fault during iterations.
Fix											X	Corrected terminology for SC34, SC35, and SC36 in Appendix C
Fix							X					Computed Lr values for small SC36 defects appearing too large and close to 1. A bug was found in the routine to compute Lr with SC36 during the conversion from reference stress to limit load.
Fix				X								Anomalous behavior of correction factors with decreasing TC28 crack length
Fix	X											When using the data migrator to convert material data to XML format, the conversion for temperature was inexact, causing minor conversion errors due to low precision and rounding issues
Fix								X				Fixed a problem for generating the fit data points of DKth vs. R in NASMAT for R = 1.0
Fix			X									The "visualize current block" dialog from Load Blocks tab would not display some controls in their proper locations
Fix			X									Incorrect Lr values shown in OUT2 file with limit stress subjected to multiple temperature application. Incomplete implementation was found in this specific multi-temperature application such that both yield and ultimate stresses were not determined.
Fix				X								Revision on pre-integrated global force and local moment employed with SC36 to be consistent with hand-calculated values
Fix			X									Crack case TC28: In inverse mode, TC28 would create a flawed batchfile blocking computation
Fix			X									Removing ADVISORY message from OUT1 file from implicit NASFLA analysis. The message remains in SCREEN.OUT file
Fix			X									Indirect NASFLA analysis for CC26 initial flaw size failed with an error message. A memory management scheme during transition was found at fault during iterations.
Fix			X									When plotting IDs from the Compare IDs dialog, the user entered values for x-axis plots "Xmin" and Xmax" were not being used in the plot, and remained at the default values
Fix			X	X	X	X	X					When using the feature "Select multiple input files and run them…," upper case characters in the file names were not being retained.
Fix			X									Crack cases CC23, TC30: The column header for "Pin hole diameter D" in the parameter analysis grid on the Computations tab was incorrectly labeled 'r' instead of 'D'
Fix					X							When selecting "New Project" in the NASCCS GUI, the following fields were not being cleared, and incorrectly retained any previously entered values: DK1, Cth, Cth-, a0, Kth(s)/Kth(l), 1-D table
Fix				X								Plotting correction factors for TC01 with user-defined y-axis plot limits not working correctly for user-provided plot limits.
Fix				X								When loading input files for 1D crack cases that use the "plot solutions" option, some controls would be inadvertently displayed on the Output Options tab and this could block computation unless plot solutions was reselected
Fix				X								API interface routine for TC29 to compute SIFs not implemented
Fix			X									Crack case KT03: A line to contain the beta R factor in the batch file was erroneously missing, preventing the data table from being plotted
Fix									X			Due to an improperly placed unicode character, NASBEM would not properly display output files
Fix				X								TC28 SIF calculation reprogrammed to reduce the lead time to expand reference solution arrays when developing a bivariant counterpart of TC28

NASGRO v10.1b Additions, Changes, and Fixes by NASGRO Module

April 15, 2022

	Applicable NASGRO Module											
Category	NASGRO Main	Config Control	NASFLA	NASSIF	NASCCS	NASGLS	NASFAD	NASMAT	NASBEM	NASFORM	Users Manual	**Description**
Fix					X							On the Output Options tab, when switching between "Basis for calculating critical crack size," the applied stresses text controls would not always show properly
Fix				X								GUI issues with NASSIF plotting for TC23 were corrected by changing the output crack tip labels from a- and c-tips to c- and c1-tips for consistency.
Fix					X							Crack case TC11: The geometry grid entry "c/c1" was incorrectly relabeled as "a/c" after turning on then off the option "Symmetric crack with symmetric stressing"
Fix					X							All possible file selector buttons were incorrectly being shown (instead of only those that were applicable) on the Load Blocks tab, when the "Basis for calculating critical crack size" of "Fatigue crack growth threhsold" is selected on the Output Options tab, and the option "Select files containing long blocks" was chosen in "For this block"
Fix				X								Crack cases KT01, KT02, KT03: An internal code error prevented the data tables from being plotted
Fix			X									Debug mode KT02 K table plotting option fixed
Fix											X	The Chang-Willenborg equation (2.1.30) was corrected to remove an incorrect term

NASGRO v10.1f Additions, Changes, and Fixes by NASGRO Module

August 15, 2022

Category	Applicable NASGRO Module											Description
	NASGRO Main	Config Control	NASFLA	NASSIF	NASCCS	NASGLS	NASFAD	NASMAT	NASBEM	NASFORM	Users Manual	
Fix			X									SC05 scale factor multiplier with net section stress check not converging and showing error at the end of OUT1 file. One of the backup files for the NSY message was not being properly closed out, triggering an error check statement.
Fix			X									Some steps appear to not be showing up in the OUT2 file with complex load spectra, resulting in incorrect final failure cycles. An inconsistent flag was being passed to the driver program, failing the cycle count scheme.
Fix				X								Crack case SC30 erroneously reporting stress files as having invalid format, preventing computation.
Fix							X					Crack case SC04 checking residual stress files even when residual stress is not selected, leading to erroneous error messages about missing files, preventing computation
Fix			X	X	X	X						The displayed file path and name for a selected stress file on the Geometry tab was not always being correctly shortened, if the combination of path and name are too long to display completely on screen. The previous logic to remove mid-string characters and replace them with "..." for the display was functioning properly for a long path, but not for a long filename itself.
Fix			X									When using the "Compare IDs" feature opn the Material tab, if you are comparing three IDs, the material selection dialog for the third ID should default to the values of the second selected ID, for ease of selecting that third ID. This was not happening, and no defaults were being automatically selected (as happens when selecting a second ID, which automatically defaults to the first ID's values.)
Fix			X									Crack case SC33 erroneously showing limit stress options.
Fix							X					In the NASFAD GUI, the "continue SIF compouding" and "do not continue SIF compounding" checkboxes on the Geometry tab were incorrectly being displayed for all the crack cases that have SIF compounding.
Fix			X									An internal coding error caused some SIF compounding table data to not get written to the FLABAT batch file for various crack cases.
Fix			X									Incorrect conversion of bivariant polynomial stresses to univariant polynomial stresses during conversion from EC04 to TC11 or TC12. The recast of stress gradients was reworked to ensure consistency.
Fix			X			X						The Load Blocks tab could erroneously be selected without a crack case selected.
Fix			X									FAD plotting within the NASFLA GUI was not complete when the "limit load" option is enabled. With limit load checked, the GUI would plot only the Kr Limit vs Lr Limit, and not Kr vs Lr. When limit load is checked, both plots should be issued, which the GUI now does. Also, the limits plot was labeld incorrectly as Kr, Lr; this has been corrected with Kr Limit, Lr Limit labels.
Fix			X									SC35 computation hung with a specific combination of defect size and diameter. The issue unfolded when the crack tip perimeter was extremely close to a circular shape. A slight adjustment was made to ensure the short and long axes to be identical such that a formulation for circular shapes can be used. The revision has been applied to the following models: SC34 external defect, SC35 external defect, and both SC36 external and internal defects.
Fix				X								On the Output Options tab under "plot solutions," the "user defined y-axis plot limits" radiobox and the y min and y max values were not being saved to the input file, nor being loaded from correct input files.
Fix			X									Crack case CC08 would erroneously hide the "Bypass Net Section stress checks" option on the Load Blocks tab, preventing the inclusion of the NSY option into the batchfile and blocking computation.
Fix			X									Ramberg-Osgood properties were echoed at the wrong location in OUT1 files. This was identified when multi-temperature applications were employed. The output of elastic-plastic properties appeared between the two rows of material table signifying two temperatures.
Fix			X				X					On the materials tab, when using multi-temperature data sets under FAD cases, the various FAD values would not be properly saved between temperature sets.
Fix				X								Crack case TC29, when centered and using the "plot solutions" option on the Output Options tab, would erroneously attempt to display plots for a non-existent C1 tip. Further, the tip labels for centered TC29 were incorrect on the Output Options tab under plot solutions.
Fix			X									Computation with cyclic shakedown led to failure from very high SIF with limit stress. The computed K from limit stress was found too high in view of very similar stress scale factors between applied and limit loads.
Fix			X									CC19 SIF computation for limit stress gradient after shakedown was not being implemented. New code was included to support the missing feature.
Fix			X				X					On the materials tab, the "View Basic Fit" button would not always be properly displayed on screen.
Fix			X	X	X		X					Crack case SC36: Corrected the crack case description to contain "WF solution" at the end, instead of "univariant WF."

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Fix			X									When loading an input file containing data for the scale factor grid, relating to the multiple analyses option on the Computations tab, some higher rows of the grid were not being loaded correctly, instead containing extraneous data. This was due to some missing array initializations stemming from an earlier internal expansion of that array.
Fix			X									Misdirected echo for material properties at limit stress temperature, which were not showing in OUT1 file. The error was corrected by including additional compiler directives to direct the output to binary database for final extraction.
Fix			X									The pop-up dialog listing material file differences between the input file and the material database could, for sufficient differences, hide the action buttons for the dialog without giving users an option to resize the dialog.
Fix			X									SC38 analysis crashing during transition. The root cause was identified from incomplete implementation for stress conversion in crack transition routines.
Fix				X								Crack case CC11 did not properly validate the minimum and maximum c values against input options, potentially allowing invalid geometry to be sent to the DLL.
Fix				X								Labels missing in some plots, either for correction factors or stress intensity factors. The original scheme to determine the location for the group of labels became troublesome when the maximum and minimum of the curve become very close.
Fix				X								TC23 with SIF compounding terminating with error though crack size remains in valid range. A typo was identified in compounding routine where user-specified crack lengths were not correctly used to compare against the validity limit of SIF compounding tables.
Fix				X								SC26 was not properly validating the geometry limits, potentially allowing invalid geometries to be used.
Fix			X	X	X	X						Crack case TC09: An error in a displayed limit expression was corrected from: "0 > c" (incorrect), to: "c < 0" (correct).
Fix										X		Strain-life results were not being properly displayed on the output tab.
Fix			X									Univariant and residual stress file checks were not being properly validated, potentially allowing invalid stress files to be used.
Fix			X	X	X	X						When plotting stresses from the Geometry tab and saving the images, only the plot for the first stress quantity was being saved. This was due to a malformed gnuplot script file, as well as the saved filaname not containing the specific stress quantity.
Fix				X								Crack cases SC19, SC31: Some missing internal variable initializations casued the stress quantity labels on the Output Options tab to all be set to "S0", whereas the correct display values should be "S0, S1, S2."
Fix					X							SC07 showing "infinity" crack size c. The error was found from non-initialized a/c ratio when the CCS at final iteration was determined.
Fix										X		GUI did not properly verify the selected block file existed, potentially allowing computation with missing block files.
Fix			X									Shakedown stress gradient from limit stress was not invoked if the service stress did not invoke shakedown. In a scenario where (1) shakedown analysis was requested, (2) service loads and their ranges are low, and (3) limit stresses are large, the flag status signifying shakedown from small service loads would falsely disable the effect of shakedown stress from limit stress when determining SIFs.
Fix			X									Current implementation showed the column output in OUT2 file for DKth and DKth/DK were all zeros when tabulated data format for FCG property was used. The revision now replaces these output values with "x" instead to signify these values are not specified explicitly.