

# Release Notes

10/24/2019

## General Notes

### 16.9

- Added simple matrix operations for one and two dimensional items. Operations: multiply  $A*B$ , inverse  $A^{-1}$ , transpose  $A^T$ , complex conjugate  $A^*$ , and  $A^I$  for identity matrix construction. See Anvil manual for more details. Notice the '^' symbol is used to indicate what follows is a 'superscript'.
- RUSE and N block: added Y parameter support. See N block syntax manual for details
- Fixed bug where accessing a RUSE block wire precluded using the '.R' or '.M' access methods. Specifically, "A.w2.v.M" was not working, now it should.
- Fixed bug in RUSE block where connecting pin1 of P1 or P2 to ground caused an incorrect computation. Also removed requirement for resistor in N blocks although it is left in the prototype for historic reasons.
- Added 'OneWattIntoLdotZStar'. Used to compute power losses in the receive direction. See SimSmith Manual 'Backward Computation', 'Reverse Computation' for details.
- Fixed bug in 'control right click' tuning of load which caused crash.
- Reworked SWR and RL to work reliably with reflection coefficient 'rho' greater than 1. See the SimSmith Manual chapter titled: "Complex System Impedance..."
- Added a new optional parameter to the G block called Zrx. If it is present, it is used as the impedance looking into the generator during 'reverse' computations.
- Added a new section to the SimSmith manual called 'Complex System Impedance'. Please read this if you are setting G.Zo to something with a non-zero reactance.
- Added independent voltage and current sources to RUSE and N blocks. Use with caution. Read the "N Block Syntax" manual.
- Added generalized SPRM element to RUSE and N blocks. This allows one to specify things like circulators and isolators. Can also be used for multiport transformers.
- Added 'paper's submenu from 'help'. Used to access various papers of potential interest to the advanced user. This was to clean up the 'help' menu.
- Added ability to access multidimensional 'trace' files using array syntax. Linear interpolation is employed. I added this so you could access more than one 'source' impedance in a 'LastZ.txt' file.

- Improved behavior of the File Chooser: tries to preserve extension when renaming files, and prohibits editing of 'preview' component.
- Help: Added a section containing 'scholarly' papers. So far, just a few papers dealing with complex reference impedances.
- Attempted to unify SWR, Gamma, and RL computations in their multiple instances. They should all work the same now preferring G.Zswr as a reference. When G.Zswr is missing, G.Zo is used. This took a lot of editing... please pay attention to these things for a while.
- Changed 'splat' report to be referenced the same as SWR, Gamma, and RL.
- Added 'SetGenAuxLabel' function. Allows augmentation of the lines under the G circuit element.
- Added brightness control for the Z and Y lines and legends on the Smith chart.

## 16.8

- Finalized (Cleaned up) much of the font and line width drawing routines. Nearly everything is real time responsive to fontChoice, dialogLinesOnScreen, and lineWidthMultiplier changes. (May be some oversights. Let me know.)
- Added 'save Trace' and 'add Trace' to the files menu. Support for saving traces is a work in progress, not tall traces can be saved correctly.
- Changed the options for Plot dot types. The Plot("X",Zin); will now label the button as 'X' rather than use 'X'es as the plot icon. To get 'X'es, use Plot("xes",Zin);
- Autotransformers. Fixed bug where sweeps of Hr and Hl didn't work properly along with other issues.
- Added RXZ vertical axis option for the SWR chart. Markers don't yet work properly on this axis.
- Rewrote auto transformer code to eliminate several bugs associated with sweeping.
- Changed 'power report' under each element to be INDEPENDENT of other element report and the axis choice on the Square chart. Thus, some components can be 'delta power in component' and others be 'power into the component'. Some can be 'in watts' and others in 'dBW'. The Square chart axis is now either W or dBW and can be chosen independently.
- Added ability to click on the 'vi' report in the top level circuit elements to change reported information.
- Added 'MatrixSolve' to Anvil subroutines.
- Fixed bug in 'GetRawFileData'... couldn't read some data values.
- **NOTE: changed 'Atan(x)' to assume X is purely real. Added Atan2(x) which interprets x as a complex number. Left Atan2 unchanged.**

- Introduced new transmission line model for low frequency and copper clad steel applications. See “help/papers/modeling coax” for a discussion.
- Added a small ‘SimSmithSamples’ zip file. You can fetch a copy of this zip file using ‘help/fetch SimSmithSamples’. You can select where to put it. You’ll have to unzip it manually.
- Added ‘AParamsTrackB’ function so one circuit element can ‘follow’ another. Very handy with things like having transmission line elements track.

## 16.7

- Added “.R”, “.I”, and “.X” operations to access parts of a complex number. For example, ‘dog.R’ is the same as ‘Real(dog)’, ‘dog.I’ is the same as ‘Imag(dog)’, and ‘dog.X’ is the same as ‘Imag(dog)’.
- Fixed problems with RUSE block component plot selection menus when multiple RUSE blocks are being used.
- Fixed bug where a transformer’s visual model changed but the mathematical model was not updated correctly. Fixed bug where a ‘ratio’ transformer which should have an assumed K of 1 did not always have a K of 1.
- Updated writing of touchstone files to allow writing touchstone s1p files in Y or Z format as well.
- Updated writing of all touchstone files to allow specification of the reference impedance. (The reference impedance of touchstone s2p files in Y or Z format must be 1.)
- Substantial rework on ‘dialog font sizes’. The preference ‘dialogFontSize’ has been replaced by ‘dialogLinesOnScreen’. This was done to ensure SimSmith selects a workable scale regardless of screen resolution. This is not yet well integrated with text dialogs. However, text dialog font sizes can be adjusted independently.
- Substantial rework of the line drawing routines. All line widths can be scaled using the ‘preferences/lineWidthMultiplier’. All drawn lines widths will be scaled by this factor. If the value is 0 then SimSmith will substitute a value based on the physical size of the screen. The computed value is not reported.
- For Smith chart tuning, holding ‘Shift’ and ‘Control’ will cause the Zoom to magnification 1 or magnification 10 depending on direction.

## 16.6

- In the File Chooser... if the path does not fit within the dialog window, SimSmith will truncate the path starting on the left. This is more like what Windows does.

- Square Chart Clipping... changed clipping in the square chart. Now, if a trace is not visible OR is only slightly showing, SimSmith will draw an arrow toward where the center of the trace might be found.
- Text Dialog keyboard shortcuts. Rewrote much of this code and added some commands... it might have some bugs. See the Anvil manual for more information.
- Added 'control right click' keyboard shortcut. Holding the control key and right clicking on the Smith chart will set the ohms and johms of the Load element. On the square chart, control right click of an SWR trace or a reference trace will also set the load impedance.
- Square chart: rewrote the horizontal label generator.
- Added 'command /' which will comment or uncomment the present line in a text dialog.
- Added 'view/bands menu' to control band displays on Square chart. See SimSmith manual concerning multifrequency operation.
- Improve efficiency: when a programmatic assignment is made to a parameter where the value is not changed, SimSmith WILL NO LONGER repaint or re-analyze the circuit. If this causes a problem, add 'DoRedundantAssigns' to the featuresKeys.
- LC Matching circuit element: added multiband support. See the SimSmith manual section on 'MultiBand Analisis' for details.
- Added ability to assign arrays to multivalued parameters. You can now write:  $G.MHz = \{3.75, 7.1, 14.2\}$ ; and get what you expect.
- Added 'GetParamValueArray(p0)' to get an array of values from a multivalued parameter. You can write 'GetParamValueArray(G.MHz)' and get an array of the values. You can update a value in the array through simple assignment.
- Added "L" (load), "S", (save), and "C" (capture image) to all text dialogs (except RUSE).
- Fixed bug in reading 4NEC2 output
- Fixed bug where Wave command ignored Stroke (and maybe color) modifiers.
- Fixed bizarre behavior when first harmonic was set to 0.
- Added warning when a builtin in function is invoked in the wrong block.
- Fixed crash which occurred when specifying a coupling coefficient for nonexistent inductor.
- Wave plotting now allowed with logarithmic Square chart scaling.
- Transmission Lines: added 'peakV' dictionary which estimates the peak voltage on the line (NOT max RMS) and where it is.
- Square chart SWR axis... added 'RL(db)' as option for vertical scale. Click on banner to select desired format.
- SPRM Square chart... Added T(db) and  $\Gamma$ (dB) as options for 'transfer' and 'reflection' axes.

- Transmission lines: fixed bug in computation of '.i', '.v', and '.z' for series transmission lines. Also affected 'peakV' value.
- The computation of 'revV' has been changed. Previously, the 'revV' was computed the same way that 'useZo' was computed. Now, it is computed the same way as 'forXfer'.

## 16.5

- Added 'GetSweepParamInfoOf' function to allow the examination and limited modification of sweep menu parameters.
- Added 'at(epilog)'. See SimSmith 'Circuit Evaluation' for more details.
- Added 'UpdateChart("tag")' to allow trigger circuit evaluation. Used in conjunction with at(epilog).
- Added 'Sleep(milliseconds)' function to allow program to pause a moment.
- Added formal arguments to class creation so one can write things like \$a=new b(1,2,3); This makes initialization of a class much easier.
- Added class augmentation when executing a new. So, one can write: \$a = new b(1,2,3) {dcl func() {return "funcCall";}};
- Added hidden variables to scan dimensions in 'BuildArray'. Make sure and read the Anvil 'Fun With Arrays'.
- Added commands to text dialogs including '^s' to start search, '^o' to open a line, '^r' to search in reverse, and '^k' to kill to end of line (or delete an empty line). Added '^y' to retrieve the killed items and insert them at the cursor. (These are very 'emacs' like. A complete reference for text edit key shortcuts is coming...)
- Added cursor movements keyboard shortcuts to text dialogs. Added ^z for recovery as well.
- Changed the symantics of Add({},a) and Add({},n,a). The call Add({1,2},{3,4}) now results in {1,2,{3,4}}. Sorry.
- Changed 'Log(0)' to return -1e200. Changed Gamma() so that if the result is small, Gamma forces it to 0. The exact cutoff is still being decided. Let me know if there's a problem.
- Fixed problem with horizontal scale labels and ranges in the Square chart.
- Fixed vertical scale label issues with the Square chart.
- Fixed bug where RUSE blocks were not recompiled properly during edits or as a result of 'Commit' or 'window closure'.
- Added GetParamFormatInfoOf(param) to get and manipulate the format information of a parameter.
- Added alias: GetParamSweepInfoOf(param) is the same as GetSweepParamInfoOf() for symmetry purposes....

- Added `RL([z],[ref])` return  $-20 \cdot \log_{10}(\text{Mag}(\text{Gamma}(z,\text{ref})))$ ; Modified `SWR` and `Gamma` to be called with no arguments. See Anvil documentation for details
- Fixed problem where 3 dimensional plots didn't display properly.
- **Changed a low level routine that lied about the length of impedance files. If you run into any problems with impedance files, please let me know ASAP.**
- Fixed problem with some systems and some mice. From Larry Benko: "Some mice and some systems have problems with detecting 'single WHEEL clicks' after 2 or more large wheel movements that occur in the SAME DIRECTION closely in time; Specifically, they get in a mode where the first wheel click is ALWAYS ignored when changing wheel direction until some other area within SimSmith is selected with the primary mouse button which clears the problem". If you observe this problem, it may be fixed (emphasis on 'may') by putting the string "UseMousePrecisionWheelFix" in the preferences/featuresKeys.

## 16.4

- FIXES RUSE PERFORMANCE PROBLEMS.
- Reworked RUSE code generator to allow 'Plot' and related functions in RUSE blocks.
- On round chart, moved SWR, Q and 'path' display to front so they aren't obscured by traces or dots on Smith charts.
- Reworked garbage collection to use less memory and cause fewer warnings.
- Reworked 'autosave' to reduce memory usage. Hopefully, this change has no effect on the user.
- Fixed 'Q' arcs when center of Smith chart isn't purely real.
- Added 'Stroke' support for dots so line width is taken into account when drawing dots.
- Show 'Smith()' plotted item values in 'path' display as well.
- Made using 'commas' as the decimal separator even more forgiving...
- Disallow assignments in conditional expressions (if, for, and ?:).
- Make `Substring(str,n)` work properly.
- Added 'GetRawFileData' to provide access to raw data from CSV files. Especially useful when using 'Generic' format.
- Added 'FindRowInArray' which can be used to quickly scan an array for a given key in a given column.
- Liberalized CSV file formats somewhat to allow for optional commas and comment lines.

- KN5L transmission line database: added frequency limitations to KN5L database. Moved frequency limited models to end of menu.
- Rewrote the 'hidden window' code to try to avoid hiding dialogs....
- Improved Marker placement.
- Improved 'logStep' in sweep expressions.
- Added '<save>' option to circuit elements that have been added by dragging them from a file chooser to the circuit. Clicking on <save> will write the element back to the file WITHOUT any confirmation. The fact that the element was loaded from a file is not yet stored in the ssx file.
- Can now attach markers to waveforms. The 'secs' field is the editable one...
- Restored array declarations and BuildArray() to the Anvil compiler and documentation.
- Added 'ValueOf' function for converting strings back to numbers.
- Added 'ComputeInternals' to allow access to the transmission line database and transmission line model.
- Added dictionaries for C and L in the LC matching circuit.

## 16.3

- Wrote new, concise, documentation for SimSmith.
- Old documents now in subdirectory under help.
- Wrote new programming manual.
- Expanded support for s2p files with  $s_{12} = s_{21} = 0$ .
- Refined when 'print' is executed.
- Added ability to control execution based on phase of evaluation
- Fixed various problems with Markers.
- Fixed a few bugs in the (now deprecated) plotting functions.
- Added 'at()' operation. See Anvil documentation.
- Added main menu item 'SimSmith'. Put preferences there. Put in 'About'. Moved 'references' to files.
- Fixed bug in expression parser where unary operators had wrong precedence.
- Added 'ArcC' and 'ArcL' to compute capacitance and inductance given impedance.
- Fixed bug in print in sweep expressions.
- Fixed bug in Plot labeling.
- Added "essentially Equals" ( $\sim=$ ) and "not essentially equals" ( $!\sim=$ ). Used when comparing numbers which should be the same but floating point rounding errors got in the way.

- Fixed bug in sweep expressions where assignments and mentions were taken as values to sweep.
- Added Zgen and Thev generator type.
- Added optional parameter Zcen.
- Widened the net for catching Zplots generated impedance files.
- Fixed hang when scanning from 10 to 10.0000000000001
- Reordered evaluation to invoke 'tunePhase' at correct time.

## 16.2

- Fixed bug where "~deg" in transmission line circuit elements was wrong.
- Augmented Transmission line database with data from KN5L.
- Added sweep capability to LC component F and H parameters.
- Suppressed generation of non-assignable parameters in Expression analysis.
- Added 'read only' to element parameters that should be read only.
- Fixed crash in Expression analysis when setting circuit element to a value.
- Fixed bug where plot couldn't 'print'.
- Fixed bug in G.V (and Isolation Block) where 'Zin' did not work properly.
- Fixed bug in G.V (and Isolation Block) where an equation was used (like Zin\*a) instead of an internal generator (like useZo or xMtch).
- Improved RUSE block interactive behavior when editing parameters.
- RUSE block now rebuilds menu when features change.
- Fixed bug in tLineDB file reader. Provide for '/' comments in tLineDB.
- Allow DragTune of Isolation block. Doesn't tell you if your are assigning the load using cloneLoad or some other mechanism.
- Added plot controls to new plotting commands.
- Fixed bug in Markers where they wouldn't attach to components with certain names.
- Fixed crash were L or G were renamed
- Fixed bug in RUSE block where transmission lines ends were not allowed to float.

## 16.1

- Now allow the '.v' after a signal name in a RUSE block. Thus 'A.sig.v' is the same as 'A.sig'.
- Updated wireman 553 window line to reflect KN5L measured data.



- SimSmith now writes '.ssx' files. These files may or may not be compatible with previous versions... it depends on the features used. Older, '.ss' files can still be read.
- Mouse Wheel Gain and direction... have been replaced with a new preference: "wheelGain p S h v R". Takes five values close to 1. The gains are for the 'p'arameters, the 'S'mith chart, 'h'orizontal, 'v'ertical, and 'R'use.
- Added "x /\_ y" operator (slash underscore). It rotates x by y degrees.
- RUSE: you can now zoom in and out in the schematic.
- TEXT DIALOGS: the font size of an expression text dialog can be increased or decreased using the '+' and '-' buttons on the lower right hand side of the dialog near the 'commit' button.
- Circuit Elements: if you have a circuit element in the main menu that is taking room but you don't need to see, you can make it narrow using the 'left arrow to margin' button on the upper left hand side of the element. Once narrow, you can widen it by clicking on it.
- Transmission Line Database: added ability to add transmission lines to the database. File/preferences/tLineDB. Entries should be of the form:  
"description (display name)" 50 .82 66.01m .2888 2.125m  
added entries will not overwrite built in ones but they will be listed first.  
There is nothing magic about any of the words. Quotes are required. The file has to be read in each time you start SimSmith.
- Added 'Preferences' document to 'help' menu.
- Added ability to control color and stroke for Plot(), Smith(), RMS(), etc commands.
- Make 'signal name' optional in Plot(), Smith(), etc. commands. So 'Smith(L.Z);' is the same as "Smith('L.Z',L.Z);"

## 16.0

### bug fixes from 15.1:

- Fixed bug were SimSmith crashed when preferences/pinSizeAndLocation was set to something other than 'useIncoming' and certain older files were loaded.
- Changed the formatting of numbers in reports to provide the number of digits specified by that parameter. The number of digits shown for a frequency specified by a load file may be problematic.
- Smith Chart: fixed bug where operating points were not displayed for plotted items on the Smith chart.
- RUSE: added the ability to delete line segments. While wiring, if you hit 'd', SimSmith will delete all line segments attached to the wiring sprite.
- RUSE: fixed bug with cut/paste of blocks 'stitching' back in incorrectly.

- RUSE: fixed bug where things could be placed 'off canvas' and then become abandoned.
- Fixed 'run away' "Extra Info". Now it is limited to 30 lines AND will only be computed when it is being displayed.
- Fixed bug when drag tuning a component with a parameter with a 'format'.

## EMPHASIS:

- TRANSFORMERS: ideal transformers aren't as ideal as they used to be. Transformers with inductors with values  $> 1$  may be problematic.
- In the past identifier 'I' was used to specify the 'incoming impedance' in the various blocks (RUSE,N,F,V). This variable has been replaced by 'Zin'.
- Identifiers can be used for only one purpose. Thus, "RO R0 w1 w2;" is no longer allowed. To simplify the transition forward, in a RUSE block, any component where the location is the same as the value: the value is changed by adding an '\_' to the name. Any RUSE or N block parameter which consists of one of the letters R, L, C, or T followed by a string of digits will be converted to lower case. Any RUSE circuit element which has the same value as location will have the location converted to lower case. This feature can be disabled by preferences/xlateNAndRUSEParam.
- New RUSE elements will have default parameter names set to their location name followed by an '\_'.
- "I" cannot be used as a circuit element name.
- The parallel operator, that used to be '|' has been replaced with '|||'. The '|' operator is now 'bitwise or' to be consistent with C. I expect not many people used the parallel operator.
- The power operator '^' has been preserved but can also be invoked with "\*\*": a to the b power is  $a^b$  or  $a**b$ . Bitwise exclusive or can be invoked with '^ ^'. For example,  $1^2$  is 3. I doubt anyone will use it, but there it is.
- Filter generation routines are presently under development and not available in version 16.0.

## additions:

- Plot and sweep expressions can now create main circuit element parameters.
- Added 'invZ' for plotting. This allows one to run the 'inverse' of the Circuit. This is essentially the same as reversing the circuit and negating all the values of the parameters. The most common use is probably "plot L.invZ;". The generator is set to 'xMtch(1)' when computing the 'inverse' info.
- This release is a rewrite all 'expression' parsing: literally a fork lift for everything F,N,RUSE,V,Plt,expr related. As a result, there will undoubtedly be incompatibilities and missing features, particularly semantic checking. This release is recommended for those requiring faster execution in circuits using

expressions. It is expected this release will generate backward compatible .ss files for simple circuits. However, if you use any of the following features, chances are things won't be backward compatible.

- Numeric parameters can now hold complex values. The imaginary part may be ignored silently. The 'L' and isolation elements are special in that the equation for the impedance is  $R + j X$  even when R and X are complex. (G.Zo also pays attention for the imaginary part.)
- Parameter values are now maintained with full machine precision. This means that the number displayed IS NOT NECESSARILY the value being used for the computation. This is how spreadsheets work. THIS IS A MAJOR CHANGE FROM SIMSMITH IN THE PAST although it is doubtful it makes any difference to the typical user.
- The expression editing window is now different. Please watch the video called "Introduction to SimSmith 16" for more details. It is easy to use but there are some hidden useful tricks.
- Added a 'Daemon' block which can be placed anywhere in the circuit INCLUDING before the Load element. It operates essentially the same as the F block except it is more efficient. It cannot affect the impedance passing through the block. Use of this element will generate files incompatible with previous releases.
- Added the ability to 'reverse' the display of the circuit. This does NOT change the order of evaluation in any way; it is strictly a display choice. The 'view' menu can be used to choose between 'legacy order' and 'standard order'.
- This release is a major break in GUI philosophy. I have started to use the Java Swing window layout managers and so the new windows are not as refined as those of the past. (Well, the file chooser used Java window layout managers as well...) I figured my time was better spent on 'core strengths' which is certainly not GUI stuff...
- NOTE: the old SimSmith used '^' and '|' in ways inconsistent with most modern programming languages. The '^' (power) operator has been preserved and '\*\*' has been added as an equivalent. Future releases may remove the '^' so it should be converted to '\*\*' any time a file is touched. The '|' (parallel) has been replaced with '|||'. The Java and C '^' (bitwise exclusive or) can be invoked with '^ ^'. The reasoning: not many users of SimSmith will need bitwise exclusive or, but many already used power....
- Changed 'plot' selection menu to be two lines.
- Added 'plot selection' menu to RUSE block components... just right click on the component for a list of items easy to plot.
- Added the ability to do simple plots from Daemon blocks. See the end of the Presenter plotting discussion.
- Plot: horizontal and vertical lines and points are no longer supported. Additionally, many 'consistency' checks are not yet performed. For example,

displaying totalPower on the Smith chart is nonsense but may not be checked.

- Plot: the syntax for overriding elements in colors has changed. Now uses the 'With' function: With(color,"alpha",0) will result in a color with alpha = 0.
- Plot: assignments in the Plot expression assignments are no longer 'temporary'. If you used this feature in the past, I apologize; it was just too difficult to carry forward.
- Plot: only one signal can be plotted with a single plot statement: "plot G.V,L.V;" is no longer legal.
- In the F block: specifying a capacitance could be done saying "C318p". Now, the syntax is C(318p). Likewise, L(), R(), and X().
- PLOT: note that the 'internals' of RUSE and N blocks are now named differently. Please see the Presenter documentation.