Xyce™ Parallel Electronic Simulator
Version 6.10 Release Notes

Sandia National Laboratories

October 30, 2018

The ***Xyce***™ Parallel Electronic Simulator has been written to support the simulation needs of Sandia National Laboratories' electrical designers. ***Xyce***™ is a SPICE-compatible simulator with the ability to solve extremely large circuit problems on large-scale parallel computing platforms, but also includes support for most popular parallel and serial computers.

For up-to-date information not available at the time these notes were produced, please visit the ***Xyce***™ web page at `http://xyce.sandia.gov`.

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New Features and Enhancements

New Devices and Device Model Improvements

- An exponential temperature coefficient (TCE) was added to the resistor device.
- The lossy and lossless transmission lines (O and T devices) now work in harmonic balance analysis (see bug 970-SON in the Known Defects table for more detail).
- The BSIM-CMG version 110 (MOSFET level 110) has been extensively optimized and now runs much faster than it did in previous releases. The original, unoptimized version remains available as MOSFET level 1110. The original version will be kept in **Xyce** for several releases, but will be removed eventually.
- The 3-terminal version of VBIC 1.3 (BJT level 11) has been extensively optimized and now runs much faster than it did in previous releases. The original, unoptimized version remains available as BJT level 111. The original version will be kept in **Xyce** for several releases, but will be removed eventually.
- The VBIC version 1.2 (BJT level 10) is deprecated and *will be removed* in the next version of Xyce. Users of VBIC are strongly advised to begin using the VBIC 1.3 3T device instead. Not only is VBIC 1.2 less numerically robust than VBIC 1.3, it is unsupported and the performance optimizations that have been applied to VBIC 1.3 will not be performed on VBIC 1.2. See the **Xyce** Reference Guide for details on how VBIC 1.2 netlists may be converted to use VBIC 1.3 instead.
- The HICUM L2 model has been updated to the latest version (2.4.0).
- A long-standing bug in applying capacitor initial conditions in one specific use case has been fixed. This bug was present only when `IC=` was specified on the instance line of a capacitor and either `NOOP` or `UIC` was used on a `.TRAN` line to skip the operating point computation of a transient.

Enhanced Solver Stability, Performance and Features

- Improved robustness for HB analysis when the TAHB option is turned off.

Interface Improvements

- Sampling methods (Monte Carlo and Latin Hypercube Sampling) are now supported in Xyce, using the `.SAMPLING` command to specify sampling options, and `.MEASURE` for statistical outputs.
- Sweep loops can now be specified using the HSpice-style `.DATA` command. This capability has been applied to `.STEP`, `.DC` and `.AC` analysis. This allows the user to specify parameter loops in which multiple parameters are changed simultaneously.
- `.AC` analysis can now sweep magnitude and phase at the same time as frequency. Previously, `.AC` was restricted to only sweeping frequency.
- For linear circuits, `.AC` analysis can now also sweep device parameters at the same time as frequency, magnitude and phase.
- For sensitivity analysis, `.PARAM`, `.GLOBAL_PARAM` and `.FUNC` now work inside of objective functions.
- Model binning based on length and width parameters is now supported for MOSFET devices.
- A new “general external interface” API has been added to provide a general mechanism for coupling an external simulator to **Xyce**.

Important Announcements

- It has been determined that some distributions of Linux have broken builds of OpenMPI in their package repositories. Building **Xyce** from source code in parallel with these OpenMPI installs will result in a version of **Xyce** that may crash on some problems. This is not a bug in **Xyce**, but a packaging error of the OpenMPI package on those operating systems. Please see commentary in the "Known Defects" section of these release notes under bug number "967-SON".

- Xyce has deprecated the default conversion of quoted-string file names to a table of x,y pairs of data. The old convention of `PARAMETER="file.dat"` which worked in some model statements and in behavioral sources will now generate a warning in the **Xyce** output. The correct way to specify a file of data for a paramater is to use the new `tablefile` keyword as in `PARAMETER=tablefile("file.dat")`. While this release of **Xyce** will accept both the old and new syntax, a future release will only accept the syntax of `PARAMETER=tablefile("file.dat")`. Additionally, a new syntax of `PARAMETER=string("string value")` has been introduced to specify parameters that are pure strings. This will be deprecated in the next release and the simpler syntax of `PARAMETER="string value"` will be used to specify string valued parameters.

Defects Fixed in this Release

Table 1: Fixed Defects. Note that we have two different Bugzilla systems for Sandia users. SON, which is on the open network, and SRN, which is on the restricted network.

Defect	Description
1040-SON: Capacitor initial conditions incorrectly applied with NOOP	**Xyce** was incorrectly applying initial conditions from the `IC` parameter of capacitors in the specific case of transient runs with `NOOP` or `UIC` keywords on the `.TRAN` line. This has been fixed, and now these initial conditions are applied in a manner that produces identical results to the other methods of specifiying initial conditions. **Note:** This bug did not apply to initial conditions specified on `.IC` lines, or initial conditions applied when an operating point was calculated (i.e., without `NOOP` or `UIC` on the `.TRAN` line). Those other use cases have always been correct.
1038-SON: **Xyce** will not run a netlist with a .LIB statement that includes a subcircuit	**Xyce** rigorously supports the HSPICE .LIB syntax. In correcting this behavior for **Xyce** version 6.9, a small logic error was introduced that could cause issues with parsing library definitions when subcircuit definitions were inside. This has been corrected.
1033-SON: Issues with use of reserved words TEMP and VT in expressions in device instance parameters and .GLOBAL_PARAM statements	If the reserved words `TEMP` or `VT` were used in expressions for device instance parameters or in `.GLOBAL_PARAM` statements then their values would always be 0. This is fixed now.
1030-SON: The N() operator does not work in expressions	The syntax `.PRINT TRAN N(A)` where A was a valid node name in the netlist did not work. It would return a parsing error about "Function or variable N() is not defined". This is fixed now.
1026-SON: Fix issues with ordering of .HB (or .NOISE) and .OP statements in a netlist	If the `.OP` statement preceded the `.HB` statement (or `.NOISE` statement) in the netlist then no `.OP` output would be made. Instead, an error message about the analysis and print types being inconsistent would be produced, if the netlist also had a `.PRINT HB` (or `.PRINT NOISE`) line in it. This is fixed now.
1021-SON: Segfaults from improperly formatted .SENS lines and improper handling of vector parameters on .OPTIONS lines	Extra or missing commas on `.SENS` or `.OPTIONS` lines could cause **Xyce** to segfault during netlist parsing. Also, a missing or misformatted `PARAM` variable on a `.SENS` line could also cause a segfault during netlist parsing. This is fixed now.
1020-SON: F and H sources incorrectly handle when gain is expression	**Xyce** always converts F and H sources (current-controlled current source and current-controled voltage source, respectively) into equivalent B sources when the netlist is parsed. It was recently discovered that the code would produce an invalid expression for the B source if the user had specified the gain (or transresistance) of the device as a brace-delimited expression, and **Xyce** would exit with a syntax error that inadequately explained the problem. The conversion of F and H sources into B sources has been fixed and now **Xyce** will perform correctly even if the user specifies the gain as an expression.
1012-SON: Incorrect values for failed EQN Measures when used with .STEP	The values for a failed EQN measure in the `<netlistname>.mtx` or `<netlistname>.msx` files were incorrectly reported as 0 rather than as the "default value" (`DEFAULT_VAL`) if `.STEP` was used in the netlist. This is fixed now.

Table 1: Fixed Defects. Note that we have two different Bugzilla systems for Sandia Users. SON, which is on the open network, and SRN, which is on the restricted network.

Defect	Description
1011-SON: Fix behaviors of .PRINT HB_FD and .PRINT HB_TD lines	In previous **Xyce** versions, no harmonic balance output would be produced if the netlist only had a `.PRINT HB_FD` line or a `.PRINT HB_TD` line, but not both. In addition, it was not possible to request different print formats on the `.PRINT HB_FD` and `.PRINT HB_TD` lines. Both of these issues are fixed now.
1000-SON: Fix the measurement window information in the stdout for a failed DC measure	The descriptive output (to stdout) for a failed DC measure was incomplete. For that case, it now contains the start and end values of the first variable in the DC Sweep vector, since those values likely did not overlap with the FROM-TO window for that DC measure. For a netlist with a .OP statement but no .DC statement, no measurement window information will be printed to stdout now since there is no DC sweep vector in that case.
958-SON: Support voltage operators (e.g., V()) for .PRINT NOISE	This line (`.PRINT NOISE INOISE ONOISE V(4)`) would print out "all zeroes" for `V(4)` in the output file, rather than the complex values from the AC solution. This is fixed now.
966-SON: Improve compatibility of -r command line option with multifile output	In previous **Xyce** versions, no output was produced for `.PRINT SENS` or `.PRINT HOMOTOPY` lines when the -r command line option was used to get RAW file output. This was changed so that the output from any `.PRINT SENS` or `.PRINT HOMOTOPY` lines is now generated, as specified by those two print lines, when -r is used. The new behavior is documented in the "Output File Redirection" section of the **Xyce** Users' Guide.
941-SON: Extra columns in .hb_ic.prn and .startup.prn files when separate .PRINT HB_FD and .PRINT HB_TD lines were used in a netlist	For previous versions of **Xyce**, the columns in those two output files would be the combination of the columns requested by the `.PRINT HB_FD` and `.PRINT HB_TD` lines. This is fixed now in the sense that a `.PRINT HB_FD` line now only produces the `<netlistname>.HB.FD.prn` file and a `.PRINT HB_TD` line now only produces the `<netlistname>.HB.TD.prn` file. If the `<netlistname>.hb_ic.prn` and `<netlistname>.startup.prn` files are needed then either a `.PRINT HB` line or explicit `.PRINT HB_IC` and `.PRINT HB_STARTUP` lines should be used.

911-SON: Improve compatibility of multi-file output with the -o command line option	If **Xyce** was invoked with the -o command line option then the output could be "interleaved" in one file. For example, if the netlist `example.cir` had these two `.PRINT` lines:
	`.PRINT TRAN V(1)`
	`.PRINT HOMOTOPY V(1)`
	and was invoked with `Xyce -o output.text example.cir` then the output that would normally appear in separate `example.cir.prn` and `example.cir.HOMOTOPY.prn` files would be jumbled together in the single file `output.txt`.
	This was fixed by simplifying the behavior of the -o command line option. See the new "Output File Redirection" section of the **Xyce** Users' Guide for more details.

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Defect	Description
718-SON: Missing error message for invalid nodes in expressions on .PRINT lines	If an invalid node is specified on a **Xyce** `.PRINT TRAN` line then **Xyce** returns a fatal error during netlist parsing (e.g., `.PRINT TRAN V(BOGONODE)` will produce an error message of `undefined symbol in .PRINT command: node BOGONODE`, if `BOGONODE` does not exist in the netlist). However, if the invalid node was inside a **Xyce** expression (e.g., `.PRINT TRAN {V(BOGONODE)}`) then **Xyce** did not produce an error message during netlist parsing and the output value for `{V(BOGONODE)}` would be zero for all time-steps. This is fixed now. For the expression case, **Xyce** netlist parsing will now emit an error message like `Function or variable V(BOGONODE) is not defined.`
707-SON: Fix behavior for invalid nodes on .FOUR lines and in .MEASURE statements	There were issues with `.FOUR` lines and `.MEASURE` statements that accidentally used node names that were not in the netlist. In that case, the `.cir.four` output file would contain a mix of all zero's and NaN's, and **Xyce** would not produce a warning or error message about the invalid node name. Similarly, the measure statement would run without a warning message about the invalid node name. The measure result would then be zero, rather than FAILED. **Xyce** parsing will now issue an error message instead. An example is "Function or variable V(A) is not defined" when V(A) refers to an invalid node name on `.FOUR` or `.MEASURE` lines.
274-SON: String valued parameters not working as expected	String values are interpreted as a filename and then parsed into a table expression. This limits the ability of **Xyce** to take pure string values and assign them to parameters. For this release **Xyce** will issue a warming when it encounters the syntax `PARAMETER="filename"` and recommend using the new syntax `PARAMETER=tablefile("filename")`. In a future **Xyce** release the old syntax, `PARAMETER="filename"`, will only attempt to assign the string to the parameter and not try to automatically read it in as a data file. Thus, the old syntax for specifying a filename from which to read data will not work. So, it is recommended that users use this release to transition to the new `PARAMETER=tablefile("filename")` syntax. Additionally, this release introduces `PARAMETER=string("string value")` to specify parameters that are just strings. In a future release, the `string()` keyword will be deprecated and the syntax for specifying string valued parameters will become `PARAMETER="string value"`.
1063-SON: The device initial states are not set correctly when the tahb option is turned off in HB analysis	This bug could have affected the convergence of HB for the circuits with certain devices, such as BJTs. This is fixed now.
1060-SON: The startupperiods option and .IC do not work together for HB analysis	The `startupperiods` option and `.IC` can help find a good initial guess for HB analysis. When they were used together, the initial condition found by startup transient analysis was overwritten by the IC specified in the `.IC`. This is fixed now.

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Defect	Description
1962-SRN: Voltages from interface nodes for subcircuits may not work correctly in expressions on `.PRINT`, `.MEASURE`, `.FOUR`, `.SENS`, `.RESULT`, `.IC` and `.NODESET` lines	An expression that used a voltage from an interface node to a subcircuit on a `.PRINT` line would only work if that voltage node was also used outside of the expression on the `.PRINT` line. A simple example was as follows. The expression {`V(X1:a)*I(X1:R1)`} would print out as 0, unless `V(X1:a)` was also on the `.PRINT` line. Similar issues also existed for `.MEASURE`, `.FOUR`, `.SENS`, `.RESULT`, `.IC` and `.NODESET` lines. This bug has been fixed for all of those line types now.
1070-SON: Parameters specified with curly braces confuse **Xyce** sensitivity analysis	If the parameters specified for sensitivity analysis were surrounded by curly braces (as one might do if they were global parameters, by convention), sensitivity analysis couldn't find the parameter properly, but didn't exit with an error. Instead it computed an incorrect answer. This is fixed now.
1073-SON: Sensitivities which rely on finite differences are badly broken in transient	There was an error in how numerical derivatives were computed that caused them to be incorrect for transient direct sensitivities. This did not affect steady-state (DC) sensitivities, and it also did not affect sensitivities that relied entirely on analytical derivatives. This is fixed now.
1077-SON: Transient sensitivity analysis seg faults if used with .STEP or .SAMPLING	There was a mistake in how the nonlinear solver was reset between step iterations. This is fixed now.

Interface Changes in this Release

Table 2: Changes to netlist specification since the last release.

Change	Detail
The behavior of .PRINT HB_FD and .PRINT HB_TD lines has changed	The .PRINT HB_FD and .PRINT HB_TD lines no longer produce "fallback" print lines. They now only produce the <netlistname>.HB.FD.prn and <netlistname>.HB.TD.prn files, respectively.
The FORMAT=PROBE and FORMAT=RAW print formats for Harmonic Balance (HB) output have changed	Those two print formats are still unsupported for HB output. However, they now default to FORMAT=STD with file extensions that end in .prn. In earlier versions of **Xyce**, some of those output files had extensions that ended with .unknown. In addition, all of those output files were in FORMAT=NOINDEX rather than FORMAT=STD.
The use of the -r and -a command line options with a netlist that uses .HB is now a parsing error	Raw file output is not currently supported for .HB analyses. Previously, the **Xyce** netlist would run but not produce any output files if the -r command line option was requested for a .HB analysis. That case is now a netlist parsing error.
The filenames for the output files produced by .PRINT AC and .PRINT HB lines that have FILE=<name> qualifiers on them has changed	See the "Multi-File Output for AC and HB Analyses" subsection of the **Xyce** Users' Guide for more information.
Error handling for the -remeasure command line option	In previous **Xyce** releases, -remeasure would run even if all of the nodal voltages, requested by the netlist's .MEASURE statements, could not be parsed from the remeasured output file. **Xyce** will now generate an error for that case, since some of the re-measured values might be incorrect.
A .OP statement is required in the netlist to enable AC_IC output	In previous **Xyce** releases, the AC_IC output would be enabled, for a netlist that used .AC analysis, if the netlist had either a .OP statement or a .STEP statement. A .OP statement is now required to enable the AC_IC output, which is consistent the documentation in the **Xyce** Reference Guide.

Known Defects and Workarounds

Table 3: Known Defects and Workarounds.

Defect	Description
1037-SON: The use of non-constant values in .PARAM statements may lead to unexpected results	This netlist line (`.PARAM PA = {TEMP}`) is forbidden in Xyce since the special variable `TEMP` is not constant. However, that netlist line will not produce a **Xyce** parsing error, and the value of `PA` in the simulation may then be set to zero in some contexts. ***Workaround***: Non-constant values should only be used in `.GLOBAL PARAM` statements in **Xyce**. This restriction may be different than in other Spice-like simulators.
1031-SON: .OP output is incomplete in parallel	When **Xyce** is run in parallel, the `.OP` output may be incomplete. ***Workaround***: One workaround is to run the netlist in serial. Another one is to use these command line options: `-per-processor -l output`. In that case, the per-processor log files will have the `.OP` information for the devices that were instantiated on each processor.
1009-SON: Transient adjoint sensitivities don't work with `.STEP`	Transient adjoint sensitivities require backward integrations to be performed after the primary transient forward integration. Doing this properly requires information to be stored during the forward solve, and for certain bookkeeping to be performed. Currently, these extra operations to support transient adjoints are not properly set up for `.STEP` analysis. ***Workaround***: None
1006-SON: SDT (expression library time integration) derivatives are not supported, so SDT can't be used for sensitivity analysis objective functions	SDT is a function supported by the **Xyce** expression library to compute numerical time integration. When this function is used, the expression library does not produce correct derivatives. This impacts Jacobian matrix entries, when SDT is used with a Bsrc, and it also impacts sensitivity analysis, when SDT is used in an objective function. For the former case, this can result in a lack of robustness for circuits that contain SDT-Bsrc devices. For the latter case, the objective function will simply be incorrect. ***Workaround***: None

1004-SON: Ill-defined .STEP behavior for "default parameters" for transient sources (SIN, EXP, PWL, PULSE and SFFM)	If, for example, these netlist lines are used in a transient (`.TRAN`) simulation:
	
	`V1 1 0 SIN(0 1 1)`
	`.STEP V1 1 2 1`
	
	then **Xyce** will run the simulation without warnings or errors, but no instance parameter of source `V1` will be stepped. ***Workaround***: Explicitly use the desired stepped parameter (e.g., `V0`) on the `.STEP` line. For example, `.STEP V1:V0 1 2 1` would work correctly.

991-SON: Non-physical BH Loops in non-linear mutual inductor	Nonlinear mutual inductors that have high coupling coefficients (i.e. model parameter `ALPHA` over 1.0e-4) and low loss characteristics (i.e. zero `GAP`) can produce B-H loops with nonphysical hysteresis. ***Workaround***: Lower `ALPHA` values or larger `GAP` values can ameliorate this issue, but the root cause is still under investigation.

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Defect	Description
989-SON: I(*) will not print branch currents that are part of a Y device	Bug 715-SON (I(*) for subcircuit devices does not work properly on .PRINT lines) was fixed for the **Xyce** 6.9 release. The caveat is that I(*) still does not work for branch currents that are part of a Y device. ***Workaround***: Explicitly request those Y-device branch currents on the `.PRINT` line.
971-SON: Use of default device parameter syntax on a .PRINT line causes **Xyce** to print 0 for that parameter	This line (`.PRINT TRAN R1`) will cause **Xyce** to print 0 for the resistance value of R1. ***Workaround***: Use `.PRINT TRAN R1:R` instead.
970-SON: Some devices do not work in frequency-domain analysis	Devices that may be expected to work in AC or HB analysis do not at this time. For AC this includes, but is not limited to, the lossy transmission line (LTRA) and lossless transmission line (TRA). For HB, the transmission lines do work but the nonlinear dependent sources (B source and nonlinear E, F, G, or H source) do not. ***Workaround***: The LTRA and TRA models will need to be replaced with lumped transmission line models (YTRANSLINE) for AC analysis. There is not yet a workaround for the B source in harmonic balance.

Table 3: Known Defects and Workarounds.

Defect	Description
967-SON: Zoltan segmentation fault with OpenMPI 2.1.x and 3.0.0 on some systems	It has been observed that when **Xyce** and Trilinos are built with OpenMPI 2.1.x or 3.0.0 on certain unsupported operating systems, a small number of test cases in the regression suite crash with a segmentation fault inside the Zoltan library. The **Xyce** team has determined that this is not a bug in either **Xyce** or Zoltan, but is instead due to some pre-packaged OpenMPI binaries on some operating systems having been built with an inappropriate option. This option, "–enable-heterogeneous" is explicitly documented in OpenMPI documentation as broken and unusable since 2013, but some package managers have OpenMPI binaries built with this option explicitly enabled. Turning on this option causes the resulting OpenMPI build to perform certain communication operations in a way that does not adhere to the MPI standard. There is nothing that can be done in **Xyce** or Zoltan to fix this issue — it is entirely a bug in the OpenMPI library as built on that system. A new test case has been added to the **Xyce** test suite in order to detect this problem. The test is "MPI_Test/bug_967", and it will be run whenever the test suite is invoked with the "+parallel" tag as described in the documentation for the test suite at `https://xyce.sandia.gov/documentation/RunningTheTests.html`. If this test fails, your system has a broken OpenMPI build that cannot be used with **Xyce**. At the time of this writing, this issue is present in Ubuntu Linux versions 17.10 and later, and there is an open bug report for it at `https://bugs.launchpad.net/ubuntu/+source/openmpi/+bug/1731938`. The issue may be present in other distros of Linux that are derived from Debian (as is Ubuntu), but we cannot confirm this. ***Workaround***: The only workaround for this problem is to build OpenMPI from source yourself, and not to include "–enable-heterogeneous" in its configure options. You should also post a bug report in your operating system's issue tracker requesting that they rebuild their OpenMPI binaries without the "–enable-heterogeneous" option. If you are using Ubuntu, you should register with that issue tracking system and add yourself to the list of people it affects in the existing bug report (doing so increases the "heat" of the bug, which may increase the likelihood of it being fixed).
964-SON: Compatibility of .PRINT TRANADJOINT with .STEP	The use of `.PRINT TRANADJOINT` is not compatible with `.STEP`. The resultant **Xyce** output will not be correct. ***Workaround***: There is none.
939-SON: Invalid fields (XBEGIN, XEND and SUBTITLE) in **Xyce**-generated HOMOTOPY.csd files	The fields in the #H header block of the .HOMOTOPY.csd files are currently hard-coded to 0 and 1, respectively. The `SUBTITLE` field is incorrect for `.STEP` data. It is missing the values for the stepped parameters. ***Workaround***: There is no workaround for the `XBEGIN` and `XEND` issue. However, it should not affect the "viewability" of those files in the PSpice A/D viewer. The workaround for the `SUBTITLE` issue is to put the stepped parameters on the `.PRINT HOMOTOPY` line.

Table 3: Known Defects and Workarounds.

Defect	Description
932-SON: Analysis lines do not support expressions for their operating parameters	The **Xyce** parser and analysis handlers do not yet support the use of expressions on netlist analysis lines such as `.TRAN`. The parameters of these analysis lines (such as stop time for `.TRAN` or fundamental frequency for `.HB`) may only be expressed as literal numbers. ***Workaround***: There is no workaround internal to **Xyce**. Use of an external netlist preprocessor would be required.
928-SON: The .hb_ic.prn file can be incorrect when .STEP is used with .HB	**Xyce** should only output the initial condition (IC) data for the accepted tolerance in the `<netlist-name>.hb_ic.prn` file. However, it currently outputs all of the intermediate IC data while harmonic balance tries to find a good tolerance if `.STEP` is used with `.HB`. ***Workaround***: There is no workaround.
883-SON .PREPROCESS REPLACEGROUND does not work on nodes referenced in expressions	The `.PREPROCESS REPLACEGROUND` feature does not replace ground synonyms if they appear in B source expressions. ***Workaround***: Do not use ground synonyms (`GND`, `GROUND`, etc.) in expressions. Use a literal "0" when referring to the ground node in expressions.
855-SON: Missing error message when a netlist uses an operator (e.g., IR or P) that is not supported for .AC analyses	**Xyce** will output all zeroes or all NaNs, for the requested quantity, when a netlist uses an operator (e.g., `IR` or `P`) that is unsupported for .AC analyses. Instead, **Xyce** should report a netlist-parsing warning or error for this case. ***Workaround***: There is none, other than noticing that an output waveform value is unexpectedly all zeroes or all NaNs.
812-SON: Undocumented limitations on, and bugs with, parameter and global parameter names	Based on external customer input and pre-release testing, there are some bugs and undocumented limitations on parameter and global parameter names in **Xyce**. Parameters and global parameters should start with a letter, rather than with a number or "special" character like #. In addition, the use of a single character V as a global parameter name can result in either netlist parsing failures or incorrect results from `.PRINT` lines.
807-SON: BSIM4 convergence problems with non-zero rgatemod value	There have been reports of convergence problems (e.g., the **Xyce** simulation fails part way through and says that the "time step is too small") when the `rgatemod` parameter is non-zero.
794-SON: Bug in TABLE Form of **Xyce** Controlled Sources	In some case, a **Xyce** netlist that contains a controlled source that uses the TABLE form will get the correct answer at first. However, it may then "stall" (e.g, keep taking really small time-steps) and never complete the simulation run. ***Workaround***: In some cases, the TABLE specification for the controlled source can be replaced with a Piecewise Linear (PWL) source that uses nested IF statements.
783-SON: Use of ddt in a B-Source definition may produce incorrect results	The `DDT()` function from the **Xyce** expression package, which implements a time derivative, may not function correctly in a B-Source definition. ***Workaround***: None.

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Defect	Description
727-SON: **Xyce** parallel builds hang randomly on OS X	During Sandia's internal nightly testing of the OSX parallel builds, we see that **Xyce** "hangs on exit" with an estimated frequency of less than 1-in-5000 simulation runs. We have not seen this issue with parallel builds for either RHEL6 or BSD. The hang is on exit, whether on a successful exit or on an error exit. The hang occurs after all of the **Xyce** output has occurred though. So, the user will get their sim results, but might have trouble if the individual **Xyce** runs are part of a larger script. ***Workaround***: None.
661-SON Lead currents and power accessors (I(), P() and W()) do not work properly in .RESULT Statements	There are two issues. First, `.RESULT` statements will fail netlist parsing if the requested lead current is omitted from the `.PRINT TRAN` line. As an example, this statement (`.RESULT I(R1)`) requires either `I(R1)`, `P(R1)` or `W(R1)` to be on the `.PRINT TRAN` line. Second, the output value, in the `.res` file, for the lead current or power calculation will always be zero.
652-SON: HB output is buggy	While a straightforward use of `.print HB` works as described in the **Xyce** Users' Guide and Reference Guide, several of the documented features do not work as intended. More details are provided by other entries in this table.
583-SON: Switch with RON=0 leads to convergence failure.	The switch device does not prevent a user from specifying `RON=0` in its model, but then takes the inverse of this value to get the "on" conductance. The resulting invalid division will either lead to a division by zero error on platforms that throw such errors, or produce a conductance with "Not A Number" or "Infinity" as value. This will lead to a convergence failure. ***Workaround***: Do not specify an identically zero resistance for the switch's "on" value. A small value of resistance such as 1e-15 or smaller will generally work well as a substitute.
469-SON: Belos memory consumption on FreeBSD and excessive CPU on other platforms	Memory or thread bloat can result when using multithreaded dense linear algebra libraries, which are employed by Belos. If this situation is observed, either build **Xyce** with a serial dense linear algebra library or use environment variables to control the number of spawned threads in a multithreaded library.
468-SON: It should be legal to have two model cards with the same model name, but different model types.	SPICE3F5 and ngspice only require that model cards of the same type have unique model names. They accept model cards of different types with the same name. **Xyce** requires that all model card names be unique.
250-SON: NODESET in **Xyce** is not equivalent to NODESET in SPICE	As currently implemented, `.NODESET` applies the initial conditions given throughout a full nonlinear solve for the operating point, then uses the result as an initial guess for a second nonlinear solve with no constraints. This is not the same as SPICE, which merely applies the given initial conditions to a single nonlinear solve for the first two iterations, then lets the problem converge with no further constraints. This can lead to a **Xyce** `.NODESET` failing where the same netlist in SPICE might not, if the initial conditions are such that a full nonlinear solve cannot converge with those constraints in place. There is no workaround.
247-SON: Expressions don't work on .options lines	Expressions enclosed in braces ({ }) are handled specially throughout **Xyce**, and may only be used in certain contexts such as in device model or instance parameters or on `.PRINT` lines.

Table 3: Known Defects and Workarounds.

Defect	Description
49-SON Xyce BSIM models recognize the model TNOM, but not the instance TNOM	Some simulators allow the model parameter TNOM of BSIM devices to be specified on the instance line, overriding the model parameter TNOM. **Xyce** does not support this.
27-SON: Fix handling of .options parameters	When specifying .options for a particular package, what gets applied as the non-specified default options might change.

2119-SRN: Voltages from interface nodes for subcircuits do not work in expressions used in device instance parameters	This bug can be illustrated with this netlist fragment:
	
	`X1 1 2 MySub`
	`.SUBCKT MYSUB a c`
	`R1  a b 0.5`
	`R2  b c 0.5`
	`.ENDS`
	`B1 3 0 V={V(X1:a)}`
	
	This fragment will produce the netlist parsing error `Directory node not found: X1:A`. The workaround is to use `V={V(1)}` in the B-source expression instead. This bug also affects the solution-dependent capacitor.

1923-SRN: LC lines run out of memory, even if equivalent (larger) RLC lines do not.	In some cases, circuits that run fine using an RLC approximation for a transmission line, exit with an out-of-memory error if the (supposedly smaller) LC approximation is used.
1595-SRN: **Xyce** won't allow access to inductors within subcircuits for mutual inductors external to subcircuits	It is not possible to have a mutual inductor outside of a subcircuit couple to inductors in a subcircuit. ***Workaround***: Put all inductors and mutual inductance lines that couple to them together at the same level of circuit hierarchy.

Supported Platforms

Certified Support

The following platforms have been subject to certification testing for the **Xyce** version 6.10 release.

- Red Hat Enterprise Linux® 7, x86-64 (serial and parallel)
- Red Hat Enterprise Linux® 6, x86-64 (serial and parallel)
- Microsoft Windows 10®, x86-64 (serial)
- Apple® OS X Sierra, x86-64 (serial and parallel)

Build Support

Though not certified platforms, **Xyce** has been known to run on the following systems.

- FreeBSD 10.x on Intel x86-64 architectures (serial and parallel)
- Distributions of Linux other than Red Hat Enterprise Linux 6
- Microsoft Windows under Cygwin and MinGW.

Xyce Release 6.10 Documentation

The following **Xyce** documentation is available on the **Xyce** website in pdf form.

- **Xyce** Version 6.10 Release Notes (this document)
- **Xyce** Users' Guide, Version 6.10
- **Xyce** Reference Guide, Version 6.10
- **Xyce** Mathematical Formulation
- Power Grid Modeling with **Xyce**
- Application Note: Coupled Simulation with the **Xyce** General External Interface

Also included at the **Xyce** website as web pages are the following.

- Frequently Asked Questions
- Building Guide (instructions for building **Xyce** from the source code)
- Running the **Xyce** Regression Test Suite
- **Xyce**/ADMS Users' Guide
- Tutorial: Adding a new compact model to **Xyce**

External User Resources

- Website: http://xyce.sandia.gov
- Google Groups discussion forum: https://groups.google.com/forum/#!forum/xyce-users
- Email support: xyce@sandia.gov
- Address:

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