# Reference Guide



## Libraries

- bootstrapLib - *does the work needed to load and enable veeos*
- codeLib - *Programming aids*
- dataLib - *Create, modify, translate, analyze and otherwise manipulate data.*
- eeLib - *Functions related to Electrical Engineering.*
- mathLib - *General mathematics functions*
- netLib - *Functions that use the internet.*
- sigLib - *Signal processing components*
- sysLib - *Functions related to the operating system and the general computer environment.*
- veeosLib - *Functions that didn't fit elsewhere or that help manage the library.*

## Functions

*These standard functions correspond directly to a single object so that the identical functionality can be used in expressions or as objects.*

*NOTE that the actual function name adds a prefix ("o_") to the object names. For example the polarResample object has underlying function o_polarResample()*

- addField - *Adds to an existing record a field with specified name and value.*
- arrayConcat - *joins together arrays*
- arrayRev - *reverses the order of any 1D array*
- buildField - *Creates a field with specified name and value.*
- colMax - *Array statistics - determines the Maximum value of each column in an array*
- colMean - *Array statistics - determines the Mean value of each column in an array*
- colMedian - *Array statistics - determines the Median value of each column in an array*
- colMin - *Array statistics - determines the Minimum value of each column in an array*
- colMode - *Array statistics - determines the Mode of each column in an array*
- colRMS - *Array statistics - determines the RMS value of each column in an array*
- colSDev - *Array statistics - determines the Standard Deviation of each column in an array*
- colVari - *Array statistics - determines the Variance of each column in an array*
- concat2D ~~- joins together 2D arrays~~ - *deprecated in favor of arrayConcat*
- concat3D ~~- joins together 3D arrays~~ - *deprecated in favor of arrayConcat*
- currentHumidity - *returns the current humidity for a given city*
- currentTemp - *returns the current temperature for a given city*
- dcBlock - - *removes the DC component of a signal*
- decayFilter - *Implements a filter whose response is based on a given decay rate.*
- dif - *calculates difference between successive data points*
- downloadLatestLibrary - *Downloads the latest version the VEEOS library.*
- dutyCycle - *Determines the duty cycle of an arbitrary signal*
- envelope - *Constructs an envelope for arbitrary signals.*

- eval - *Evaluates the given function at the given argument.*
- fallTime - *Determines the fall time of an arbitrary signal*
- frequency - *Determines the dominant frequency of an arbitrary signal.*
- funcFilter - *Implements an analog filter with transfer response specified by an arbitrary function.*
- hilbert - *Computes the Hilbert transform of the input waveform.*
- ifThenEval - *Defines a function of multiple domains - is also a general Case statement.*
- importCLib - *Imports a Compiled Library*
- importULib - *Imports a User Library*
- isElement - *determines if a given element exists within a set*
- isPrime - *Determines if a number is prime.*
- longLat - *returns the longitude and latitude for a given city*
- period - *Determines the period of an arbitrary signal.*
- PI - *Evaluates the product of a series.*
- polarFit - *Determines the unique circle defined by given three points.*
- polarRegress - *Determines the circle that best fits a set of points.*
- polarResample - *Resamples polar data to ensure full 0-360 coverage.*
- polyFilter - *Implements an analog filter with transfer response specified by numerator and denominator polynomials.*
- popupNotice - *Creates a pop-up message on the user's screen*
- ppCap - *Calculates Parallel Plate Capacitance*
- riseTime - *Determines the rise time of an arbitrary signal*
- randomInt - *Returns a random integer from specified range.*
- randomReorder - *scrambles the order of a string or array.*
- rootFilter - *Implements an analog filter with transfer response specified by poles and zeroes.*
- setAND - *returns the set of elements that are in both of two sets*
- setComplement - *Returns the set of elements that are in one set but not in the other.*
- setOR - *returns the set of elements that are in either of two sets*
- setXOR - *returns the set of elements that are in either but not both of two sets*
- setVar - *Sets (or creates) a variable with given name and value*
- SIGMA - *Evaluates the sum of a series.*
- strReplace - *Replaces occurrences of a target string within the input string.*
- time - *Converts timestamp to time of the day.*
- timeStretch - *Stretches a series of data points by replicating them.*
- toCoord - *Creates Coordinates from input data.*
- toggleRadix - *Switches decimal radix between point and comma*
- toInt16 - *Interprets input as hex value and outputs it as a 16-bit signed integer*
- toInt32 - *Interprets input as hex value and outputs it as a 32-bit signed integer*
- toUInt8- *Interprets input as hex value and outputs it as an 8-bit unsigned integer*
- toBinStrN - *Formats a number as a binary string of arbitrary length.*
- unique - *returns unique subset*
- unzip - *Uses standard ZIP to unpack zip bundles.*
- uudecode - *Unpacks a coded ASCII file into the original format of the enclosed file.*
- uuencode - *Unpacks a coded ASCII file into the original format of the enclosed file.*
- wait - *Pauses execution for specified time in seconds*
- week - *Converts timestamp to week of the year.*
- winVersion - *Find the version of Windows which is currently running.*
- zip - *Uses standard ZIP to bundle whatever source files are specified.*

## Standalone Objects

*These objects (or groups of objects) have no single underlying matching function.*

- analogAmp - *configurable analog amplifier*
- analogFilter - *configurable analog classical filter*
- bitStream - *display optimized to show bit pattern of digital stream*
- downConvert - *mixer-based down-conversion object*
- forEach - *Program construct for looping through a set of values.*
- negBridge - *negative polarity full-wave bridge rectifer*
- negRectifier - *negative polarity half-wave rectifer*
- numberStream - *display optimized to show streaming analog data*
- posBridge - *negative polarity half-wave rectifer*
- posRectifier - *negative polarity full-wave bridge rectifer*
- toBinStr8 - *Formats a number as a binary string of length 8.*
- toBinStr16 - *Formats a number as a binary string of length 16.*
- toBinStr32 - *Formats a number as a binary string of length 32.*
- toBinStr64 - *Formats a number as a binary string of length 64.*
- upConvert - *mixer-based up-conversion object*
- veeosInit - *Initializes the loading of veeos*

## Standalone Functions

*These functions have no single overlying matching object but may of course still be used as desired.*

*NOTE that the actual function name adds a prefix ("o_") to the names shown. For example the polarResample object has underlying function o_polarResample()*

- aAmp - *generic analog amplifer*
- aFilter - *generic classical analog filter*
- aMixer - *generic analog mixer*
- aRectifier - *generic analog rectifier*
- butterPoly - *generates Butterworth polynomials*
- chebyPoly - *generates Chebychev polynomials*
- comma2point - *Replaces commas with points.*
- point2comma - *Replaces points with commas.*
- Xcoord - *Returns the X value of a coordinate*
- Ycoord - *Returns the Y value of a coordinate*
- Zcoord - *Returns the Z value of a coordinate*

 Stan Bischof (stan@worldbadminton.com). Last updated 10 November 2015 21:06.

# bootstrapLib

*Does the work needed to load and enable veeos*

## Functions

- init - *load and enable veeos*

## Extended Objects

## Notes

BootstrapLib itself is just a library. All the work is actually done by a function inside it called init()

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# bootstrapLib:  init()

*Load and enable veeos.*

## Syntax

init()
no inputs
return: none

## Usage

This function is designed to be invisible to the end user and to not be explicitly called. Instead it is run in the background by veeosInit.

## Location

library: bootstrapLib

## Notes

Since init() is called by veeosInit which in turn is to be included in all VEE programs that use the veeos library, it is designed to be as small as possible and to have the absolute minimum hard-coded functionality. In essence it does nothing other than to find an RC file and then executes the directives included in that RC file.

In searching for an RC file, init() searches the below locations in series and concatenates all the directives found. This order is chosen for standard precedence: the most specific directive takes precedence if there is more than one conflicting definition.

1. Worldwide global - RC file is downloaded from veeos.org
2. VEE Install directory- searched for veeos.rc
3. Home directory - searched for veeos.rc
4. Local directory - searched for veeos.rc

Note that since the RC files are concatenated and then the directives in them are executed in order, the last RC file takes precedence. This conforms with standard precedence that says most-specific should win.

Note also that these above RC files can be totally bypassed by setting an environment variable MY_VEEOSRC specifying the RC file(s) to be loaded. As with the default precedence, last files loaded take precedence.

NOTE that due to this behavior, init() can run any RC file directives that the user desires. The end result is that although init() is part of veeos it can alternately be used for initiating the end user's customizations instead (or in addition). This enable the end user program to change functionality (i.e. overriding) depending upon the environment in which it is run.

## Reference

The default veeos RC file is self documenting but the documentation is also included here for reference. Note that the RC file directives include loading libraries and setting variables. The also can be used to automatically execute functions.

```
### User Function Libraries to load. Space delimited. Field order dependent
```

```
# ulib <name> <file> [<function to execute>]

# examples
# ulib dt VEEROOT/veeos/lib/dtLib.vxe
# ulib dt "C:\program files\Agilent\Vee Pro 7.0\veeos\lib\dtLib.vxe" init()

### Compiled Function Libraries to load. Space delimited. Field order dependent.
# clib <name> <file> <definition file> [<function to execute>]

# example
# clib io  VEEROOT/veeos/lib/ioLib.dll  VEEROOT/veeos/lib/ioLib.h

### set up variables
# gvar <name> <type> <value>

# example
# gvar eps0 Real64 8.854187817e-12
```

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

veeosInit

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# codeLib

*Programming Aids*

## Functions

- importCLib - *Imports a Compiled Library*
- importULib - *Imports a User Library*
- popupNotice - *Creates a pop-up message on the user's screen*
- wait - *Pauses execution for specified time in seconds*

## Internal Content

*These are used within the library but can often be useful directly accessed from without.*

- private functions
  - version - returns revision date of this library
- variables
  *none*

## Standalone Objects

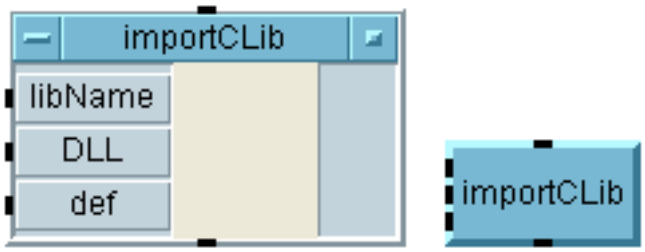
- forEach - *Program construct for looping through a set of values.*
- bitStream - *display optimized to show bit pattern of digital stream*
- numberStream - *display optimized to show streaming analog data*

## Notes

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# importCLib(libName,DLL, def)

*Imports a Compiled Library*




## Syntax

o_importCLib(libName, DLL, def)
libName: scalar Text - library name to use for the imported library
DLL: scalar text - the DLL file that is to be loaded
def: array 1D Text - the definition file contents
return: type description

## Usage

This wraps the Import Library object within a function so that it can be used in expressions.

## Location

menu: veeos ==> coding ==> importCLib

library: codeLib

## Example

o_importCLib( "games", "C:\temp\gameLib.dll", ["long __stdcall chess(int difficulty)","long __stdcall go(int difficulty)"]) imports the compiled library gameLib.dll with the library name "games".

## Notes

As with any name, do not use spaces or punctuation within the library name. If you need spaces in the library file path be sure to quote them. Unless your library is within the default search path, you will need absolute path for the library file. Note that a definition file is not needed since the function definitions are included as an argument.

## Reference

## Supported On

VEE 7.0+, Windows XP+

## See Also

importULib

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# importULib(libName,file)

*Imports a User Library*


## Syntax

o_importULib(libName, file)
libName: scalar Text - library name to use for the imported library
file: scalar Text - the VEE library file
return: none

## Usage

This wraps the Import Library object within a function so that it can be used in expressions.

## Location

menu: veeos ==> coding ==> importULib

library: codeLib

## Example

o_importULib( "games", "C:\temp\gameLib.vee") imports the user library gameLib.vee with the library name "games.

## Notes

As with any name, do not use spaces or punctuation within the library name. If you need spaces in the library file path be sure to quote them. Unless your library is within the default search path, you will need absolute path for the library file.

## Reference

## Supported On

VEE 7.0+, All platforms.

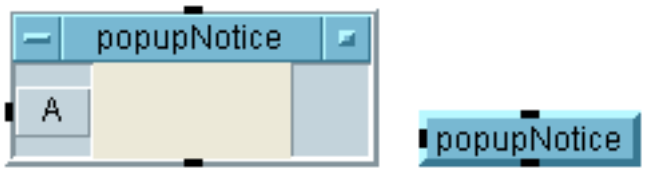
## See Also

importCLib

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# popupNotice(a)

*Creates a pop-up message on the user's screen*




## Syntax

o_popupNotice(a)
a: scalar Text - message to be displayed
return: none

## Usage

While many other mechanisms exist to place messages on the screen, this simplistic one allows asynchronous one-liners to pop up via a function call.

## Location

menu: veeos ==> Coding ==> popupNotice

library: codeLib

## Example

o_popupNotice("present status is RED")  pops up a message on the user's screen

## Notes

The popup used is asynchronous and will stay in place as long as the program is running. If you desire to eliminate it at any time, send the message "HIDENOTICE".

## Reference

## Dependencies

## Supported On

Vee 7.0+, all platforms

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:49. 

# wait(a)

*Pauses execution for specified time in seconds*


## Syntax

o_wait(a)
a: scalar Real - number of seconds to sleep
return: none

## Usage

Use this to delay execution of the next expression within a formula

## Location

menu: veeos ==> Coding ==> wait

library: codeLib

## Example

```
// now wait for 5 seconds before continuing
o_wait(5);
```

## Notes

This is seemingly identical to the Delay object, but is a function so that it can be used in expressions. This works via a direct call to the Windows Kernel. As discussed on VRF ca. 2004 (Georg Nied et al), it can be useful for resolving CPU loading issues.

## Reference

## Dependencies

- importCLib used to import kernel's sleep function

## Supported On

VEE 7.0+, Windows XP+

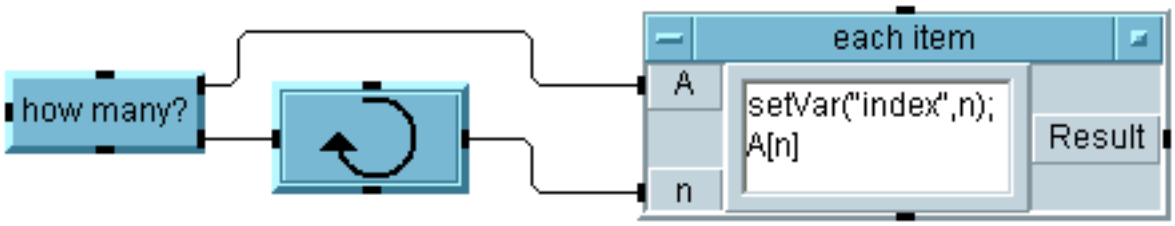
wait

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# forEach

*Program construct for looping through a set of values.*




## Syntax

forEach is a set of objects only - no underlying function
input: array of any type
output: one element of the array at a time

## Usage

Drop this set of objects down into your program wherever you need to serially process each member of an array.

## Location

menu: veeos ==> Coding ==> forEach

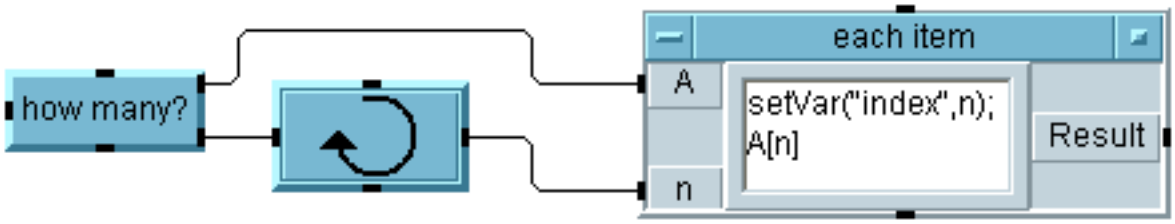
library: *none- objects only*

## Example

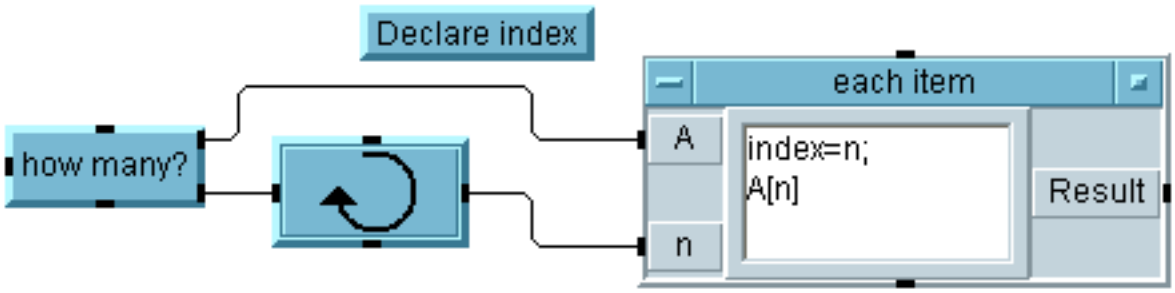
## Notes

While this is functionally the same as the forEach native object introduced with VEE8, this rendition will work equally in any version of VEE and it provides an advtange in that the index is available for use.

In some cases it may well be desirable to create an index variable for use in other sections of the program. This allows you to know where in a given list you are currently indexed. One way to do this is with a setVar(), as in




or, if you would like to reduce the scope of the index variable, you can use a Declare Variable first, as in




## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# bitstream

*Display optimized to show bit pattern of digital stream*


## Syntax

bitStream is a set of objects only - no underlying function
input: array of any type
output: display of the streaming bit pattern

## Usage

Drop this set of objects down into your program wherever you need to display the real-time signal of a streaming pattern of bits.

## Location

menu: veeos ==> Coding ==> bitStream

library: *none- objects only*

## Example

## Notes

The bitStream display was designed to display one bit from a stream of values. A typical use for this would be when streaming data through a serial IO device. By using a suitable number of bitsream displays one can simulate a simplistic bus anaylzer. This example generates a sample stream of values and displays the corresponding bit patterns. For convenience the values are also shown.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

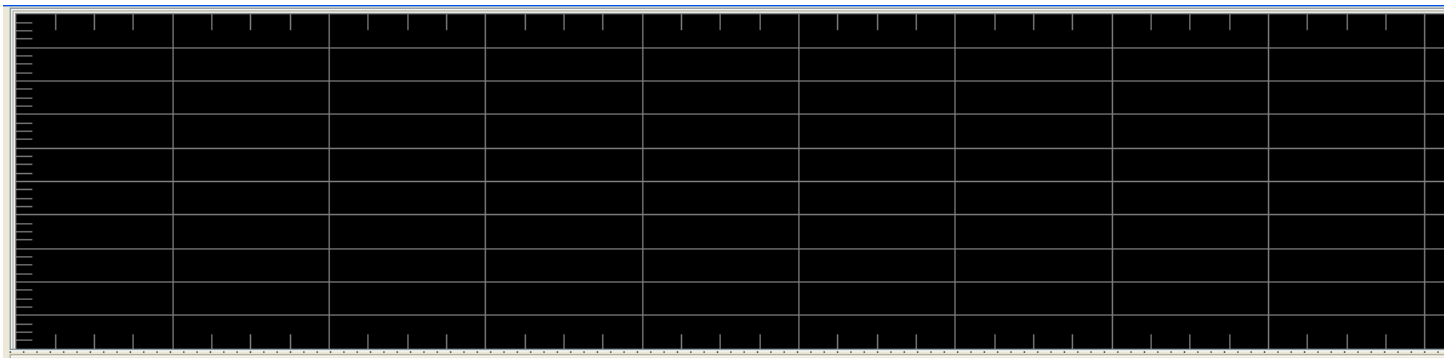
bitStream

numberStream

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# numberStream

*Display optimized to show streaming analog data*



## Syntax

numberStream is a set of objects only - no underlying function
input: array of numbers
output: display of the streaming analog value

## Usage

Drop this set of objects down into your program wherever you need to display the real-time signal of a streaming set of values

## Location

menu: veeos ==> Coding ==> numberStream

library: *none- objects only*

## Example

## Notes

The numberStream display was designed to graphically display a stream of values. A typical use for this would be when streaming data through a serial IO device and wanting to visualize the data. This example generates a sample stream of values and displays them using numberStream. For convenience the values are also shown textually. NOTE: Y scale is set at a default. reset as desired.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

bitStream

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# dataLib

*Create, modify, translate, analyze and otherwise manipulate data.*

## Functions

- addField - *Adds to an existing record a field with specified name and value.*
- buildField - *Creates a field with specified name and value.*
- comma2point - *Replaces commas with points.*
- hexToInt - *Interprets input as hex value and outputs it as an integer*
- point2comma - *Replaces points with commas.*
- polarFit - *Determines the unique circle defined by given three points.*
- polarRegress - *Determines the circle that best fits a set of points.*
- polarResample - *Resamples polar data to ensure full 0-360 coverage.*
- setVar - *Sets (or creates) a variable with given name and value*
- timeStretch - *Stretches a series of data points by replicating them.*
- toggleRadix - *Switches decimal radix between point and comma*
- toBinStrN - *Formats a number as a binary string of arbitrary length.*
- toCoord - *Creates Coordinates from input data.*
- toInt16 - *Interprets input as hex value and outputs it as a 16-bit signed integer*
- toInt32 - *Interprets input as hex value and outputs it as a 32-bit signed integer*
- toUInt8- *Interprets input as hex value and outputs it as an 8-bit unsigned integer*

## Internal Content

*These are used within the library but can often be useful directly accessed from without.*

- private functions
  - version - returns revision date of this library
- variables
  *none*

## Standalone Objects

- toBinStr8 - *Formats a number as a binary string of length 8.*
- toBinStr16 - *Formats a number as a binary string of length 16.*
- toBinStr32 - *Formats a number as a binary string of length 32.*
- toBinStr64 - *Formats a number as a binary string of length 64.*

## Standalone Functions

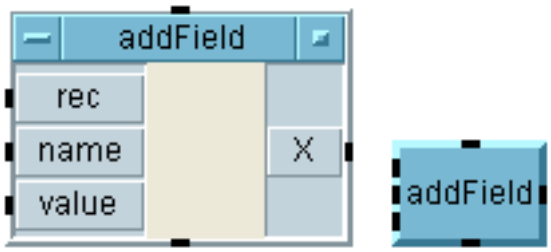
- Xcoord - *Returns the X value of a coordinate*
- Ycoord - *Returns the Y value of a coordinate*
- Zcoord - *Returns the Z value of a coordinate*

## Notes

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# addField(rec,name,value)

*Adds to an existing record a field with specified name and value.*




## Syntax

o_addField(rec,name,value)

rec: Record - an existing record
name: scalar Text - the name of a field that is to be added to the existing record
value: scalar Any - the value of a field that is to be added to the existing record
return: record - existing record with one additional field added

## Usage

Creates a new field with specified name and value and adds it to an existing record.

## Location

menu: veeos ==> Data ==> addField

library: dataLib

## Example

o_addField (A, "new", 38.7) takes the record A and adds to it a field with name "new" and value of 38.7).

## Notes

As with any record, one cannot add a field whose name matches an existing field.

## Reference

## Supported On

VEE 7.0+, All platforms.

## See Also

addField

buildField

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:31. 

# buildField(name,value)

*Creates a field with specified name and value.*


## Syntax

o_buildField(name,value)
name: scalar Text - the name of a field that is to be created
value: scalar Any - the value of a field that is to be created
return: record - record with one field as specified

## Usage

Creates a record with a single field with specified name and value.

## Location

menu: veeos ==> Data ==> buildField

library: dataLib

## Example

o_buildField ("new", 38.7) creates a record that has a single field with name "new" and value of 38.7).

## Notes

As with any field, there must be no spaces or other punctuation in the name. Value though can be anything.

## Reference

## Supported On

VEE 7.0+, All platforms.

## See Also

addField

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:31. 

# comma2point(a)

*Replaces commas with points.*

## Syntax

o_comma2point(a)
a: scalar Text - numbers as input string
return: Text - string with "," replaced by "."

## Usage

Designed to be used when presenting results of numerical computations in text format.

## Location

menu: *not included in menu*

library: dataLib

## Example

o_comma2point("23,45 24,34 89,01") returns "23.45 24.34 89.01"

## Notes

The world is split between two major groups that use a decimal radix of "," or ".". This function is provided as a quick way to switch between the two when presenting numbers in Text format. Note that strReplace() would also work but it uses loops so this one is faster.

## Reference

## Dependencies

## Supported On

VEE7.0+, all platforms

## See Also

point2Comma, strReplace, toggleRadix

# hexToInt(a)

*Interprets input as hex value and outputs it as an integer*


## Syntax

o_hexToInt(a)

a: Text - value that is assume to be hex
return: Int - input value converted to decimal integer

## Usage

Convert values from hex to decimal integer

## Location

menu: veeos ==> Data ==> Conversion ==> hexToInt

library: dataLib

## Example

o_hexToInt("ee3425a") returns 249774682

## Notes

Input can be a scalar or an array. Also can be text or numerical. This can be done with a From String, but since it is provided as a function it can be used in more places.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

toBinStr8, toBinStr16, toBinStr32, toBinStr64, toBinStrN, toUInt8, toInt16, toInt32

# point2comma(a)

*Replaces points with commas.*

## Syntax

o_point2comma(a)
a: scalar Text - numbers as input string
return: Text - string with "." replaced by ","

## Usage

Designed to be used when presenting results of numerical computations in text format.

## Location

menu: *not included in menu*

library: dataLib

## Example

o_comma2point("23.45 24.34 89.01") returns "23,45 24,34 89,01"

## Notes

The world is split between two major groups that use a decimal radix of "," or ".". This function is provided as a quick way to switch between the two when presenting numbers in Text format. Note that strReplace() would also work but it uses loops so this one is faster.

## Reference

## Dependencies

## Supported On

VEE7.0+, all platforms

## See Also

comma2point, strReplace, toggleRadix

# polarFit(a)

*Determines the unique circle defined by given three points.*


## Syntax

o_polarFit(a)

a: array 1D coord - arbitrary three points in cartesian coords
return: scalar record - center and radius of circle

## Usage

Given three points it is possible to define a unique circle. This function finds that circle and returns center and radius.

## Location

menu: veeos ==> Data ==> Circles ==> polarFit

library: dataLib

## Example

*see veeos examples inside of VEE*

## Notes

Since 3 points on a plane uniquely define a circle (unless they are colinear of course), this function can operate with a closed-form expression and hence no loops. It is fast and precise normally, but if the points are nearly colinear then the result can be noisy.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

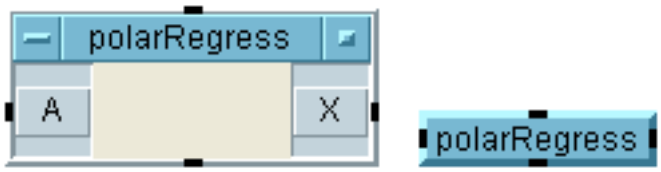
## See Also

polarRegress

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:49. 

# polarRegress(a)

*Determines the circle that best fits a set of points.*




## Syntax

o_polarRegress(a)
a: array 1D coord - arbitrary points in cartesian coords
return: scalar record with three fields
center: best fit center as coord
radius: best fit radius as real
error: estimated error

## Usage

This is designed designed to use in determining the best-fit center of a series of measured points.

## Location

menu: veeos ==> Data ==> Circles ==> polarRegress

library: dataLib

## Example

*see veeos examples inside of VEE*

## Notes

3 points on a plane uniquely define a circle (unless they are colinear of course), but if one has more than three points that don't exactly lie on a unique circle then determining a best-fit circle has no closed-form solution. Suppose, for instance, that one want to determine a circle with multiple measurements. The coordinates of a series of points near the presumed circumference are made, and then this function can be used to determine the best-fit circle. The algorithm used here is very basic so should be quite robust. Rather than using any sort of optimization, determines analytically the circles uniquely defined (see polarFit) by sets of three points from within the measurements, and then averages the resulting circle centers and radii. Note that best results are thereby obtained if the measured points are widely spaced.

If there are only three points given then this reduces to polarFit since there is then a unique answer.

Note that there are other algorithms for finding a best-fit circle which may do better with noisy data, but a long as noise level si low this works quickly and well.

## Reference

## Dependencies

## Supported On

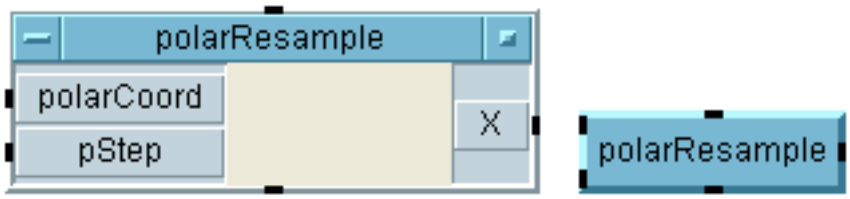
VEE 7.0+, all platforms

## See Also

polarFit

# polarResample(a)

*Resamples polar data to ensure full 0-360 coverage.*




## Syntax

o_polarResample(polarCoord,pStep)
polarCoord: Array 1D Coord or PComplex - input data
for Coords, phase is "X", mag is "Y".
pStep: scalar real - desired step size of output data
return: Array 1D Coord or PComplex - resampled data from 0 to 360-pStep degrees

## Usage

Use this to fill in missing polar data by use of interpolation

## Location

menu: veeos ==> Data ==> Circles ==> polarResample

library: dataLib

## Example

*see examples from veeos menu*

## Notes

This was written for the case of circular measurements wherein data is taken at multiple angles, but some angles are missing from the data. A typical case would be antenna measurements as in gain vs angle using a statistical measurement (i.e. random angles chosen). The data needs to be resampled for subsequent processing by a tool that requires constant angular steps. This function takes in data in either coordinates or as PComplex values, resamples, and then returns data in the same type as was input. No loops are used so this should be fairly fast. And since linear interpolation is used it should also be quite robust.

Importantly, the phase input needs to be monotonically increasing. Note that pStep is adjusted automatically such that an integer number of steps are created for 360 degrees.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

polarRegress

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:49. 

# setVar(name,value)

*Sets (or creates) a variable with given name and value*


## Syntax

o_setVar(name,value)
name: scalar Text - name of variable to be set (or created)
value: any any - value of the variable to be set (or created)
return: *none*

## Usage

Use this to set an existing variable or create a new one automatically.

## Location

menu: veeos ==> Data ==> setVar

library: dataLib

## Example

o_setVar("myvar", 567) sets the variable myvar to the value 567.

## Notes

One can of course create a new variable using a Set Variable object, and one can set a value using an assignment operator. This function essentially combines both features by setting the named variable if it already exists but also automatically creating a new variable if needed.

## Reference

## Dependencies

## Supported On

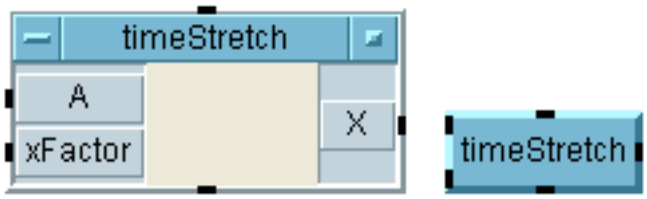
VEE7.0+, all platforms

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# timeStretch(a)

*Stretches a series of data points by replicating them.*




## Syntax

o_timeStretch(a)

a: Array1d number - an input array of numerical values
xFactor: scalar Int - number of times to repeat each input value
return: array 1D - input values repeated xFactor times

## Usage

Designed for use in graphically displaying values. Since each value is repeated multiple times, graphs are simple made with levels shown rather than just data points.

## Location

menu: veeos ==> Data ==> timeStretch

library: dataLib

## Example

o_timeStretch([2 6 3 6 7],3) returns [2 2 2 6 6 6 3 3 3 6 6 6 7 7 7]

## Notes

Where this is intended and is quite useful is in visualizing real-world signals that are controlled by discrete values. Classic case would be the time output of a DAC.

## Reference

## Dependencies

## Supported On

VEE7.0+, all platforms

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# toggleRadix(a)

*Changes points to commas- and vice versa.*


## Syntax

o_toggleRadix(a)
a: scalar Text - numbers as input string
return: Text - string with "," replaced by "." or vice versa depending upon inout

## Usage

Designed to be used when presenting results of numerical computations in text format.

## Location

menu: veeos ==> data ==> Formatting ==> toggleRadix

library: dataLib

## Example

o_toggleRadix("23,45 24,34 89,01") returns "23.45 24.34 89.01" and
o_toggleRadix("23.45 24.34 89.01") returns "23,45 24,34 89,01"

## Notes

The world is split between two major groups that use a decimal radix of "," or ".". This function is provided as a quick way to switch between the two when presenting numbers in Text format. Note that strReplace() would also work but it uses loops so this one is faster.

## Reference

## Dependencies

uses comma2point() and point2comma()

## Supported On

VEE7.0+, all platforms

## See Also

comma2point, point2Comma, strReplace

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# toBinStrN(a,nBits)

*Formats a number as a binary string of arbitrary length.*


## Syntax

o_toBinStrN(a,nBits)
a: scalar Int - value to be converted to binary string
b: scalar Int - number of digits to present
return: Text - input represented by a string of 1's and 0's

## Usage

Use this to show in human readable format the binary representation of an integer.

## Location

menu: veeos ==> Data ==> Conversion ==> toBinStrN

library: dataLib

## Example

o_toBinStrN(38,8) returns "00100110"
o_toBinStrN(345,12) returns "000101011001"

## Notes

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

toBinStr8, toBinStr16, toBinStr32, toBinStr64

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# toCoord(a)

*Creates Coordinates from input data.*


## Syntax

o_toCoord(a)
a: scalar or Array 1D Complex
or scalar or Array 1D PComplex
or array 1D or array 2D numerical
return: scalar or array 1D Coordinate

## Usage

Use this to create coordinates within an expression.

## Location

menu: veeos ==> Data ==> Conversion ==> toCoord

library: dataLib

## Example

o_toCoord((1,2)) creates a scalar coordinate with X=1 and Y=2
o_toCoord((1,@90)) creates a scalar coordinate with X=0 and Y=1
o_toCoord(<array 1D of complex>) creates a array of coordinates
o_toCoord([1,2,3]) creates a scalar 3D coordinate (1,2,3)
o_toCoord([[1,2,3],[4,5,6]]) creates an array 1D of 2D coordinates

## Notes

While VEE syntax provides the ability to create and examine Complex and PComplex data within expressions, it lack the ability to do the same with coordinates. Hence one is left with the often-clumsy need to use the Build and Unbuild Coord objects instead. This function allows the user to convert Complex and PComplex data to 2D coordinates and also allows one to build 2D or 3D coordinates from scratch using an array as input.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

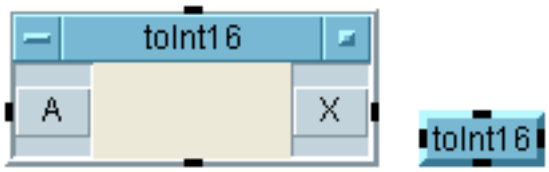
## See Also

Xcoord, Ycoord, Zcoord

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# toInt16(a)

*Interprets input as hex value and outputs it as a 16-bit signed  integer*




## Syntax

o_toInt16(a)
a: number or text- value to be converted
return: Int16 -  input value converted to signed 16-bit integer

## Usage

Convert strings or numbers to signed 16-bit integers. Text inputs assumed to be in hex.

## Location

menu: veeos ==> Data ==> Conversion ==> toInt16

library: dataLib

## Example

o_toInt16("a34") returns 2612
o_toInt16("4708") returns 18184
o_toInt16(4708) returns 4708

## Notes

Input can be a scalar or an array. Also can be text or numerical. This varies from the built-in function asInt16() in that it assumes that text inputs are hex.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

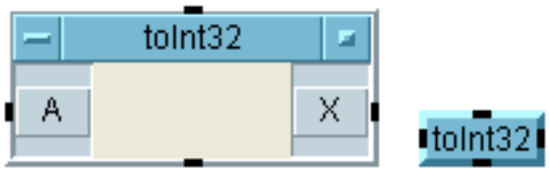
## See Also

toBinStr8, toBinStr16, toBinStr32, toBinStr64, toBinStrN, hexToInt, toUInt8, toInt32

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# toInt32(a)

*Interprets input as hex value and outputs it as a 32-bit signed integer*




## Syntax

o_toInt32(a)
a: number or text- value to be converted
return: Int32 - input value converted to signed 32-bit integer

## Usage

Convert strings or numbers to signed 32-bit integers. Text inputs assumed to be in hex.

## Location

menu: veeos ==> Data ==> Conversion ==> toInt32

library: dataLib

## Example

o_toInt32("a34a") returns 41802
o_toInt32("478823") returns 4687907
o_toInt32(478823) returns 478823

## Notes

Input can be a scalar or an array. Also can be text or numerical. This varies from the built-in function asInt32() in that it assumes that text inputs are hex.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

toBinStr8, toBinStr16, toBinStr32, toBinStr64, toBinStrN, hexToInt, toUInt8, toInt16

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# toUInt8(a)

*Interprets input as hex value and outputs it as an 8-bit unsigned integer*


## Syntax

o_toUInt8(a)
a: number or text- value to be converted
return: UInt8 - input value converted to unsigned 8-bit integer

## Usage

Convert strings or numbers to unsigned 8-bit integers. Text inputs assumed to be in hex.

## Location

menu: veeos ==> Data ==> Conversion ==> toUInt8

library: dataLib

## Example

o_toUInt8("a") returns 10
o_toUInt8("47") returns 71
o_toUInt8(47) returns 47

## Notes

Input can be a scalar or an array. Also can be text or numerical. This varies from the built-in function asUInt8() in that it assumes that text inputs are hex.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

toBinStr8, toBinStr16, toBinStr32, toBinStr64, toBinStrN, hexToInt, toInt16, toInt32

# toBinStr8(a)

*Formats a number as a binary string of length 8.*


## Syntax

- *no underlying function - use toBinStrN*
  a: scalar Int - value to be converted to binary string
  return: Text - input represented by a string of 8 1's and 0's

## Usage

Use this to show in human readable format the binary representation of an integer.

## Location

menu: veeos ==> Data ==> Conversion ==> toBinStr8

library: dataLib

## Example

toBinStr8(38) returns "00100110"

## Notes

This object is provided as a convenience only. It is a special case of toBinStrN()

## Reference

## Dependencies

uses toBinStrN()

## Supported On

VEE 7.0+, all platforms

## See Also

toBinStr16, toBinStr32, toBinStr64, toBinStrN, hexToInt, toUInt8, toInt16, toInt32

# toBinStr16(a)

*Formats a number as a binary string of length 16.*


## Syntax

- *no underlying function - use toBinStrN*
  a: scalar Int - value to be converted to binary string
  return: Text - input represented by a string of 16 1's and 0's

## Usage

Use this to show in human readable format the binary representation of an integer.

## Location

menu: veeos ==> Data ==> Conversion ==> toBinStr16

library: dataLib

## Example

toBinStr16(85267) returns "0100110100010011"

## Notes

This object is provided as a convenience only. It is a special case of toBinStrN()

## Reference

## Dependencies

uses toBinStrN()

## Supported On

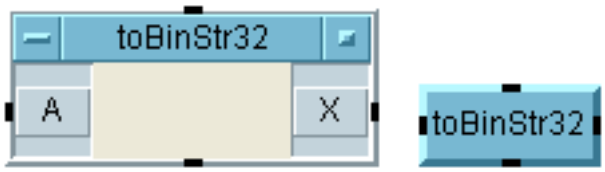
VEE 7.0+, all platforms

## See Also

toBinStr8, toBinStr32, toBinStr64, toBinStrN, hexToInt, toUInt8, toInt16, toInt32

# toBinStr32(a)

*Formats a number as a binary string of  length 32.*




## Syntax

- *no underlying function - use toBinStrN*
  a: scalar Int - value to be converted to binary string
  return: Text -  input represented by a string of 32 1's and 0's

## Usage

Use this to show in human readable format the binary representation of an integer.

## Location

menu: veeos ==> Data  ==> Conversion ==> toBinStr32

library: dataLib

## Example

toBinStr32(388775) returns "00000000000000000100101111011101111"

## Notes

This object is provided as a convenience only. It is a special case of toBinStrN()

## Reference

## Dependencies

uses toBinStrN()

## Supported On

VEE 7.0+, all platforms

## See Also

toBinStr8, toBinStr16, toBinStr64, toBinStrN, hexToInt, toUInt8, toInt16, toInt32

# toBinStr64(a)

*Formats a number as a binary string of length 64.*


## Syntax

- *no underlying function - use toBinStrN*
  a: scalar Int - value to be converted to binary string
  return: Text - input represented by a string of 64 1's and 0's

## Usage

Use this to show in human readable format the binary representation of an integer.

## Location

menu: veeos ==> Data ==> Conversion ==> toBinStr64

library: dataLib

## Example

toBinStr64(34516786785267) returns "0000000000000000000011111011001001001000011010000101010111111110011"

## Notes

This object is provided as a convenience only. It is a special case of toBinStrN()

## Reference

## Dependencies

uses toBinStrN()

## Supported On

VEE 7.0+, all platforms

## See Also

toBinStr8, toBinStr16, toBinStr32, toBinStrN, hexToInt, toUInt8, toInt16, toInt32

# Xcoord(a)

*Returns the X value of a coordinate.*

*Function only- no corresponding object*

## Syntax

o_Xcoord(a)
a: scalar or Array1D Coord - coordinate to be examined
return: scalar or Array 1D - the X value of the input coordinate

## Usage

Use this to access the X value from coordinate within an expression.

## Location

menu: *no menu pick - to access use the Function and Object browser*

library: dataLib

## Example

Given coordinate (1,2), o_Xcoord returns 1

## Notes

While VEE syntax provides the ability to create and examine Complex and PComplex data within expressions, it lack the ability to do the same with coordinates. Hence one is left with the often-clumsy need to use the Build and Unbuild Coord objects instead. This function allows one to unbuild a coordinate within an expression.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

toCoord, Ycoord, Zcoord

# Ycoord(a)

*Returns the Y value of a coordinate.*

*Function only- no corresponding object*

## Syntax

o_Ycoord(a)

a: scalar or Array1D Coord - coordinate to be examined
return: scalar or Array 1D - the Y value of the input coordinate

## Usage

Use this to access the Y value from coordinate within an expression.

## Location

menu: *no menu pick - to access use the Function and Object browser*

library: dataLib

## Example

Given coordinate (1,2), o_Ycoord returns 2

## Notes

While VEE syntax provides the ability to create and examine Complex and PComplex data within expressions, it lack the ability to do the same with coordinates. Hence one is left with the often-clumsy need to use the Build and Unbuild Coord objects instead. This function allows one to unbuild a coordinate within an expression.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

toCoord, Xcoord, Zcoord

# Zcoord(a)

*Returns the Z value of a coordinate.*

*Function only- no corresponding object*

## Syntax

o_Zcoord(a)

a: scalar or Array1D Coord - coordinate to be examined
return: scalar or Array 1D - the Z value of the input coordinate

## Usage

Use this to access the Z value from coordinate within an expression.

## Location

menu: *no menu pick - to access use the Function and Object browser*

library: dataLib

## Example

Given coordinate (1,2,3),  o_Zcoord returns 3

## Notes

While VEE syntax provides the ability to create and examine Complex and PComplex data within expressions, it lack the ability to do the same with coordinates. Hence one is left with the often-clumsy need to use the Build and Unbuild Coord objects instead. This function allows one to unbuild a coordinate within an expression.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

toCoord, Xcoord, Ycoord

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

Xcoord

# eeLib

*Functions related to Electrical Engineering.*

## Functions

- ppCap - *Calculates Parallel Plate Capacitance*

## Internal Content

*These are used within the library but can often be useful directly accessed from without.*

- private functions
  - version - returns revision date of this library
- variables
  *none*

## Standalone Objects

## Notes

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# ppCap(area, thickness, Er)

*Calculates Parallel Plate Capacitance*


## Syntax

o_ppCap(a,b)

area: scalar Real - area in mm^2
thickness: scalar Real - thickness in mm
Er: scalar Real - relative dielectric constant (unitless)
return: Real - capacitance in Farads

## Usage

Given an area and thickness plus the dielectric constant, basic physics provides the equivalent DC capacitance for two parallel conductors separated by a fixed amount.

## Location

menu: veeos ==> Engineering Calculations ==> ppCap

library: eeLib

## Example

A 1mm square pad on 10 mil high density alumina has an equivalent capacitance of o_ppCap(1, 0.25, 9.9) = 0.35 pF

## Notes

This function calculates C given the formula C=EoErA/d, which determines the classic DC parallel plate capacitance without taking into account any fringing effects. For capacitors whose electrical aspect ratio is small (very wide compared to thickness) this is a good approximation since fringing is minimal. For other capacitors one should start looking at EM techniques for a better answer.

## Reference

- One source is GSU Physics Department, although any beginning electrical field text will have this also.

## Supported On

VEE 7.0+, All platforms.

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# mathLib

*General mathematics functions*

## Functions

- arrayConcat - *joins together arrays*
- arrayRev - *reverses the order of any 1D array*
- colMax - *Array statistics - determines the Maximum value of each column in an array*
- colMean - *Array statistics - determines the Mean value of each column in an array*
- colMedian - *Array statistics - determines the Median value of each column in an array*
- colMin - *Array statistics - determines the Minimum value of each column in an array*
- colMode - *Array statistics - determines the Mode of each column in an array*
- colRMS - *Array statistics - determines the RMS value of each column in an array*
- colSDev - *Array statistics - determines the Standard Deviation of each column in an array*
- colVari - *Array statistics - determines the Variance of each column in an array*
- concat2D - *joins together 2D arrays*
- concat3D - *joins together 3D arrays*
- dif - *calculates difference between successive data points*
- eval - *Evaluates the given function at the given argument.*
- hilbert - *Computes the Hilbert transform of the input waveform.*
- ifThenEval - *Defines a function of multiple domains - is also a general Case statement.*
- isElement - *determines if a given element exists within a set*
- isPrime - *Determines if a number is prime.*
- PI - *Evaluates the product of a series.*
- randomInt - *Returns a random integer from specified range.*
- randomReorder - *scrambles the order of a string or array.*
- setAND - *returns the set of elements that are in both of two sets*
- setComplement - *Returns the set of elements that are in one set but not in the other.*
- setOR - *returns the set of elements that are in either of two sets*
- setXOR - *returns the set of elements that are in either but not both of two sets*
- SIGMA - *Evaluates the sum of a series.*
- strReplace - *Replaces occurrences of a target string within the input string.*
- unique - *returns unique subset*

## Internal Content

*These are used within the library but can often be useful directly accessed from without.*

- private functions
  - version - returns revision date of this library
- variables
  *none*

## Standalone Objects

*none*

## Notes

 Stan Bischof (stan@worldbadminton.com). Last updated 08 November 2015 20:10. 

# arrayConcat(a,b)

*Joins together arrays.*


## Syntax

o_arrayConcat(a,b)
a: array any - first input array
b: array any - second input array
return: array any - the two input arrays concatenated together

## Usage

Use this to join multiple arrays into a new array of same shape.

## Location

menu: veeos ==> Math ==> Arrays ==> arrayConcat

library: mathLib

## Example

```
               1  2  3   3  4          1  2  3  3  4
o_arrayConcat( 4  5  6 , 3  4 ) yields  4  5  6  3  4
               7  8  9   3  4          7  8  9  3  4


               1  2   3  4          1  2
o_arrayConcat( 4  5 , 3  4 ) yields  4  5
               7  8                  7  8
                                     3  4
                                     3  4
```

## Notes

While the built-in "concat()" function can join together arrays, it always flattens them into a 1D array. This function constructs a new array of same shape with the two input arrays joined side-by-side. Orientation is automatic (dimension that doesn't match gets extended. If all dimensions match then highest dim gets extended). Note that loops are not used so this function is fast.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

arrayRev

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:31. 

# arrayRev(a)

*Reverses the order of any 1D array.*


## Syntax

o_arrayRev(a)
a: array 1D Any - 1D array to be processed
return: same type as input - array is in reverse order

## Usage

Use any time you would like a 1D array in reverse order. Works with any data type.

## Location

menu: veeos ==> Math ==> arrayRev

library: mathLib

## Example

o_arrayRev( [1,2,3,4] ) returns [4,3,2,1]
o_arrayRev( ["first","second","last"] ) returns [ "last" , "second", "first" ]

## Notes

If the input is scalar no change is made. If the input is Waveform or Spectrum the data array is reversed but the time or freq mapping is unaffected. This uses no loops so is fast.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

arrayRev

arrayConcat

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:31. 

# colMax(a)

*Array statistics - determines the Maximum value of each column in an array*


## Syntax

o_colMax(a)

a: array 2D numeric - input 2D array
return: array 2D - statistics of each column

## Usage

When analyzing plentiful data, such as with a number of tests on many DUTs it can be desirable to examine the statistics of various parameters. A typical way to represent the data is in an array, with each row representing a test vector, each column a particular tested parameter. This function analyzes the Maximum value of each column- hence each parameter.

## Location

menu: veeos ==> Math ==> Arrays ===> colMax

library: mathLib

## Example

```
          4 4 5 3
o_colMax([ 3 5 4 5 ]   returns  [4 6 5 8]
          3 6 5 8
```

## Notes

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

colMean, colMedian, colMin, colMode, colRMS, colSDev, colVari

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# colMean(a)

*Array statistics - determines the Mean value of each column in an array*


## Syntax

o_colmean(a)

a: array 2D numeric - input 2D array
return: array 2D - statistics of each column

## Usage

When analyzing plentiful data, such as with a number of tests on many DUTs it can be desirable to examine the statistics of various parameters. A typical way to represent the data is in an array, with each row representing a test vector, each column a particular tested parameter. This function analyzes the Mean value of each column- hence each parameter.

## Location

menu: veeos ==> Math ==> Arrays ===> colMean

library: mathLib

## Example

```
            4 4 5 3
o_colMean([ 3 5 4 5 ]   returns  [3.33 5 4.66 5.33]
            3 6 5 8
```

## Notes

## Reference

Uses no loops so is fast.

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

colMax, colMedian, colMin, colMode, colRMS, colSDev, colVari

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# colMedian(a)

*Array statistics - determines the Median value of each column in an array*


## Syntax

o_colMedian(a)

a: array 2D numeric - input 2D array
return: array 2D - statistics of each column

## Usage

When analyzing plentiful data, such as with a number of tests on many DUTs it can be desirable to examine the statistics of various parameters. A typical way to represent the data is in an array, with each row representing a test vector, each column a particular tested parameter. This function analyzes the Median value of each column- hence each parameter.

## Location

menu: veeos ==> Math ==> Arrays ===> colMedian

library: mathLib

## Example

```
              4 4 5 3
o_colMedian([ 3 5 4 5 ]   returns  [3 5 5 5]
              3 6 5 8
```

## Notes

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

colMax, colMean, colMin, colMode, colRMS, colSDev, colVari

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# colMin(a)

*Array statistics - determines the Minimum value of each column in an array*


## Syntax

o_colMin(a)

a: array 2D numeric - input 2D array
return: array 2D - statistics of each column

## Usage

When analyzing plentiful data, such as with a number of tests on many DUTs it can be desirable to examine the statistics of various parameters. A typical way to represent the data is in an array, with each row representing a test vector, each column a particular tested parameter. This function analyzes the Minimum value of each column- hence each parameter.

## Location

menu: veeos ==> Math ==> Arrays ===> colMin

library: mathLib

## Example

```
          4 4 5 3
o_colMin([ 3 5 4 5 ]   returns  [3 4 4 3]
          3 6 5 8
```

## Notes

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

colMax, colMean, colMedian, colMode, colRMS, colSDev, colVari

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# colMode(a)

*Array statistics - determines the Mode of each column in an array*


## Syntax

o_colMode(a)

a: array 2D numeric - input 2D array
return: array 2D - statistics of each column

## Usage

When analyzing plentiful data, such as with a number of tests on many DUTs it can be desirable to examine the statistics of various parameters. A typical way to represent the data is in an array, with each row representing a test vector, each column a particular tested parameter. This function analyzes the Mode (most common value) of each column- hence each parameter.

## Location

menu: veeos ==> Math ==> Arrays ===> colMode

library: mathLib

## Example

```
           4 4 5 3
o_colMode([ 3 5 4 5 ]   returns  [3 4 5 3]
           3 6 5 8
```

## Notes

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

colMax, colMean, colMedian, colMin, colRMS, colSDev, colVari

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# colRMS(a)

*Array statistics - determines the RMS (root mean square) value of each column in an array*


## Syntax

o_colRMS(a)

a: array 2D numeric - input 2D array
return: array 2D - statistics of each column

## Usage

When analyzing plentiful data, such as with a number of tests on many DUTs it can be desirable to examine the statistics of various parameters. A typical way to represent the data is in an array, with each row representing a test vector, each column a particular tested parameter. This function analyzes the Maximum value of each column- hence each parameter.

## Location

menu: veeos ==> Math ==> Arrays ===> colRMS

library: mathLib

## Example

```
          4 4 5 3
o_colRMS([ 3 5 4 5 ]   returns  [3.37 5.07 4.69 5.72]
          3 6 5 8
```

## Notes

Uses no loops so is fast.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

colMax, colMean, colMedian, colMin, colMode, colSDev, colVari

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# colSDev(a)

*Array statistics - determines the Standard Deviation of each column in an array*


## Syntax

o_colSDev(a)

a: array 2D numeric - input 2D array
return: array 2D - statistics of each column

## Usage

When analyzing plentiful data, such as with a number of tests on many DUTs it can be desirable to examine the statistics of various parameters. A typical way to represent the data is in an array, with each row representing a test vector, each column a particular tested parameter. This function analyzes the Standard Deviaiton of each column- hence each parameter.

## Location

menu: veeos ==> Math ==> Arrays ===> colSDev

library: mathLib

## Example

```
            4 4 5 3
o_colSDev([ 3 5 4 5 ]   returns  [.82 1.41 .82 3.56]
            3 6 5 8
```

## Notes

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

colMax, colMean, colMedian, colMin, colMode, colRMS, colVari

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# colVari(a)

*Array statistics - determines the Variance of each column in an array*


## Syntax

o_colVari(a)

a: array 2D numeric - input 2D array
return: array 2D - statistics of each column

## Usage

When analyzing plentiful data, such as with a number of tests on many DUTs it can be desirable to examine the statistics of various parameters. A typical way to represent the data is in an array, with each row representing a test vector, each column a particular tested parameter. This function analyzes the Variance of each column- hence each parameter.

## Location

menu: veeos ==> Math ==> Arrays ===> colVari

library: mathLib

## Example

```
            4 4 5 3
o_colVari([ 3 5 4 5 ]   returns  [.67 2 .67 12.67]
            3 6 5 8
```

## Notes

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

colMax, colMean, colMedian, colMin, colMode, colRMS, colSDev

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# concat2D(a,b)

*Joins together 2D arrays.*

***NOTE - this function is maintained for backward-compatibility but is now deprecated in favor of arrayConcat(a,b)***


## Syntax

o_concat2D(a,b)
- a: array 2D any - first input array
- b: array 2D any - second input array
- return: array 2D any - the two input arrays concatenated together

## Usage

Use this to join multiple 2D arrays into a new 2D array.

## Location

menu: veeos ==> Math ==> concat2D

library: mathLib

## Example

```
             1  2  3   3  4          1  2  3  3  4
o_concat2D ( 4  5  6 , 3  4 ) yields  4  5  6  3  4
             7  8  9   3  4          7  8  9  3  4


             1  2   3  4          1  2
o_concat2D ( 4  5 , 3  4 ) yields  4  5
             7  8                  7  8
                                   3  4
                                   3  4
```

## Notes

While the built-in "concat()" function can join together 2D arrays, it always flattens them into a 1D array. This function maintains the 2D shape and automatically determines the correct orientation. If number of rows match then columns are joined, and if number of columns match then rows are joined. If neither match then an error is raised. Note that loops are not used so this function is fast.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

concat3D, arrayConcat

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# concat3D(a,b)

*Joins together 3D arrays.*

***NOTE - this function is maintained for backward-compatibility but is now deprecated in favor of arrayConcat(a,b)***


## Syntax

o_concat3D(a,b)
a: array 3D any - first input array
b: array 3D any - second input array
return: array 3D any - the two input arrays concatenated together

## Usage

Use this to join multiple 3D arrays into a new 3D array.

## Location

menu: veeos ==> Math ==> concat3D

library: dataLib

## Example

*See example in veeos menu.*

## Notes

While the built-in "concat()" function can join together 3D arrays, it always flattens them into a 1D array. This function maintains the 3D shape and automatically determines the correct orientation. Note that two of the dimensions need to match before it is feasible to join the arrays. If no two match then an error is raised. Note that loops are not used so this function is fast.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

concat2D, arrayConcat

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# dif(a)

*Calculates difference between successive data points.*


## Syntax

o_dif(a)

a: array numeric - array of data values
return: array numeric - difference between successive data points

## Usage

Replaces an array with the difference between successive points. This is the "delta" in difference equations. In order to maintain the same qty of values, the first data point is kept.

## Location

menu: veeos ==> Math ==> dif

library: mathLib

## Example

o_dif([1 4 3 6 7 8]) returns [1 3 -1 3 1 1]

## Notes

When creating difference equations, say *dif(a) / (dif(a) +1)* one of course needs a dif function, just as one needs an integral function for differential equations. This rendition of *dif* fits that bill. Note that *dif* should actually return one less point than the input, but in order to make successive operations easy the input array length is maintained by arbitrarily keeping the first data point in place. This will of course cause end effects.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

dif

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# eval(function,arg)

*Evaluates the given function at the given argument.*


## Syntax

o_eval(function,arg)
a: scalar Text - function of A
b: any - value of A
return: function evaluated at the given value of A

## Usage

This is designed for use in cases where the function is determined at runtime.

## Location

menu: veeos ==> Math ==> eval

library: mathLib

## Example

o_eval("2+a^2", 4) returns 18
o_eval("3*A+15","4") returns 44415

## Notes

When a formula is known at programming time it of course can be coded into a formula and then evaluated at runtime. However in cases such as filters where the function to be evaluated is itself determined only at runtime, one needs the ability to evaluate that function. eval(function,arg) provides a convenient way to do this

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

eval

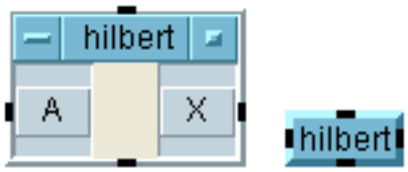
## See Also

ifThenEval

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# hilbert(a)

*Computes the Hilbert transform of the input waveform.*




## Syntax

o_hilbert(a)
a: waveform - the input waveform
return: waveform - Hilbert transform of the input waveform

## Usage

Computes the Hilbert transform.

## Location

menu: veeos ==> Math ==> hilbert

library: mathLib

## Example

For given waveform A, hilbert(a) returns the Hilbert transform of A

## Notes

The current code is based on a contribution to VRF by Tom Sanders in 1999.

## Reference

Hilbert transform is well described at Wikipedia and is a very commonly used function in Signal processing.

## Dependencies

none.

## Supported On

hilbert

VEE 7.0+, All platforms.

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# ifThenEval(cases,A)

*Defines a function of multiple domains - is also a general Case statement.*


## Syntax

o_ifThenEval(cases,A)
cases: Array 1D Record - defines the cases to be considered
A: any - defines the independent variable
return: any - for each case the result of the input formula

## Usage

Use this where you would normally use a Case statement. The input "cases" is a array of records. Each record has two fields, each of type Text and each one defining a formula to be evaluated. The "if" field of the first record (case) is evaluated. If True then the "eval" field is evaluated and the result is returned. If False then the next record (case) is evaluated the same way. As soon as any condition is matched the function exits. If no condition matches then the original value is returned.

## Location

menu: veeos ==> Math ==> ifThenEval

library: mathLib

## Example

Define a function of two domains: *A>0 and A<5* and *A>5* and two accompanying formulas *1/A* and *2*A* .
For the ifThenEval we then create a record array with two fields such that

```
rec[0].if = "A>0 and A<5";
rec[0].eval="1/A";
rec[1].if = "A>5";
rec[1].eval = "2*A";
```

Feeding values A *0,1,2,3,4,5,6,7* to *o_ofTheneval(rec,A)* we obtain an output of 0,1,1/2,1/3,1/4,5,16,14

## Notes

VEE never had a Case statement but has always needed one. Originally there was a good reason that Case was not included but, although that reason went away many years ago, Case was never added. This function was developed to fill that gap.

## Reference

## Dependencies

Use eval() extensively

## Supported On

VEE 7.0+, all platforms

## See Also

eval

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# isElement(set,element)

*Determines if a given element exists within a set.*


## Syntax

o_isElement(set,element)
a: array any - input set
element: scalar any - element to look for in the set
return: scalar int - "1" if element is in set, "0" if not

## Usage

Use this to determine if a given element exists within a set.

## Location

menu: veeos ==> Math ==> Sets ==> isElement

library: mathLib

## Example

o_isElement( [2 3 4 3 5 5 3 1] , 6) returns 0 ("false")

o_isElement( [2 3 4 3 5 5 3 1] , 2) returns 1 ("true")

## Notes

When dealing with sets it is often useful to know if an element exists within a given set. A typical case is when looking for a specific test result in an array of results, based on a specific detail like an operator name.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

setAND, setComplement, setOR, setXOR, unique

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# isPrime(a)

*Determines if a number is prime.*


## Syntax

o_isPrime(a)
a: scalar Integer - number to be tested
return: boolean - 0=not prime, 1=prime

## Usage

Use whenever you would like to test a number to see if it is prime. A typical use would be to generate a set of primes for factorization.

## Location

menu: veeos ==> Math ==> isPrime

library: mathLib

## Example

o_isPrime(4) returns 0
o_isPrime(99961) returns 1

## Notes

The algorithm used here is fairly brute-force but as such as about foolproof. While it is reasonably fast , it would not be appropriate to use for extremely large values.

## Reference

## Dependencies

## Supported On

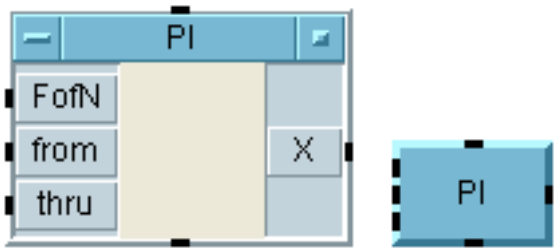
VEE 7.0+, all platforms

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 08 November 2015 15:46. 

# PI(FofN,from,thru)

*Evaluates the product of a series.*




## Syntax

o_PI(FofN,from,thru)

FofN: scalar Text - function to be evaluated with argument "n"
from: scalar number - lower limit of "n"
thru: scalar number - upper limit of "n"
return: numeric - the product of terms F(n) for n=from through n=thru

## Usage

An arbitrary function of "n" can be evaluated for a series. This implements a standard "PI" notation product.

## Location

menu: veeos ==> Math ==> PI

library: mathLib

## Example

o_PI("n^2*(n-1)",3,5) = (9*2)*(16*3)*(25*4) = 86400

## Notes

A very common operation for series is the product of the various terms. This evaluates that product.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

VEEOS

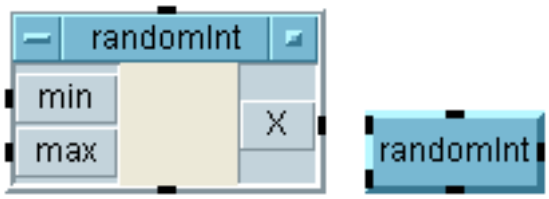
## See Also

SIGMA

 Stan Bischof (stan@worldbadminton.com). Last updated 08 November 2015 20:10. 

# randomInt(min,max)

*Returns a random integer from specified range.*







## Syntax

o_randomInt(min,max)
return: min <= random integer <= max

## Usage

Use this to generate a random integer.

## Location

menu: veeos ==> Math ==> randomInt

library: mathLib

## Example

o_randomInt(0,34) is equally likely to return any of the 35 integers in the inclusive range of 0 to 34

## Notes

This is similar to the built-in random() function, but the built-in returns real64's, this returns integers.

In looking at this function, several approaches were tried, as noted in evalRandomInt.vee. Note that it isn't hard to end up with biased result, and that some approaches are slower than others. Also, as it turns out, the "best" solution in this case is to read the Help and note that the built-in random() function uses a non-inclusive range [A,B) so can be used almost directly.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

randomReorder

 Stan Bischof (stan@worldbadminton.com). Last updated 09 November 2015 12:30. 

# randomReorder(a)

S*crambles the order of a string or array.*


## Syntax

o_randomReorder(a)
a: array or string - the set of values to be scrambled
return: same as original but scrambled into a random order

## Usage

Use this when you have a set of values but would like to scramble the order of those values.

## Location

menu: veeos ==> Math ==> Arrays ==> randomReorder

library: mathLib

## Example

o_randomReorder("this string") returns any string such as "rgnts_hstii" that has all the same characters but in a random order

o_randomReorder( [1,2,3 4] ) could return [1,4,3,2] or [4,1,3,2] or any number of other random reordering.

## Notes

This should work with any data type and scalar, 1D or 2D arrays.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

randomInt

 Stan Bischof (stan@worldbadminton.com). Last updated 06 November 2015 09:26. 

# setAND(a,b)

*Returns the set of elements that are in both of two sets.*


## Syntax

o_setAND(a,b)
a: array any - input set
b: array any - input set
return: array 1D any - array that includes all elements that are part of both A and B

## Usage

Use this to perform set operation "intersection"

## Location

menu: veeos ==> Math ==> Sets ==> setAND

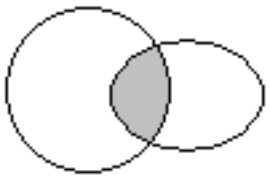
library: mathLib

## Example

o_setAND( [2 3 4 3 5 5 3 1] , [6 3 4 7 1] ) returns [3 4 1]

## Notes

setAND is equivalent to an intersection of two sets with duplicate elements removed, as in the intersecting area of a Venn diagram.



## Reference

## Dependencies

uses unique(A)

## Supported On

VEE 7.0+, all platforms

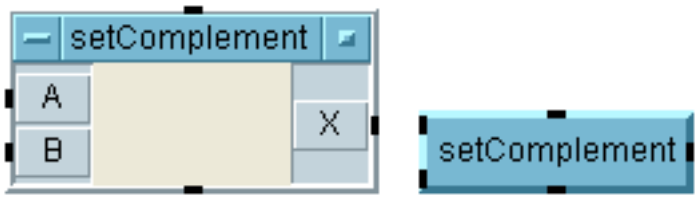
## See Also

isElement, setComplement, setOR, setXOR, unique

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# setComplement(a,b)

*Returns the set of elements that are in one set but not in the other.*




## Syntax

o_setComplement(a,b)
a: array any - input set
b: array any - input set
return: array 1D any - array that includes all elements that are part of A but not part of B

## Usage

Use this to perform set operation "relative complement", which is analogous to a subtraction.

## Location

menu: veeos ==> Math ==> Sets ==> setComplement

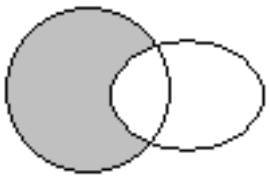
library: mathLib

## Example

o_setComplement( [2 3 4 3 5 5 3 1] , [6 3 4 7 1] ) returns [2 5]

## Notes

setComplement is equivalent to a subtraction of two sets, as in the area of a Venn diagram that is part of set A but not part of set B.



## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

isElement, setAND, setOR, unique

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# setOR(a,b)

*Returns the set of elements that are in either of two sets.*


## Syntax

o_setOR(a,b)
a: array any - input set
b: array any - input set
return: array 1D any - array that includes all elements that are part of either A or B

## Usage

Use this to perform set operation "union"

## Location

menu: veeos ==> Math ==> Sets ==> setOR

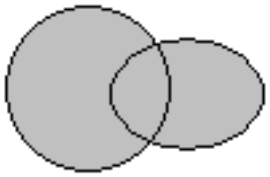
library: mathLib

## Example

o_setOR( [2 3 4 3 5 5 3 1] , [6 3 4 7 1] ) returns [2 5 6 3 4 7 1]

## Notes

setOR is equivalent to a union of two sets with duplicate elements removed, as in a Venn diagram.



## Reference

## Dependencies

uses unique(A)

## Supported On

VEE 7.0+, all platforms

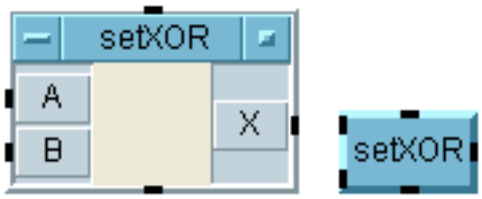
## See Also

isElement, setAND, setComplement,setXOR, unique

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# setXOR(a,b)

*Returns the set of elements that are in either but not both of two sets.*




## Syntax

o_setXOR(a,b)

a: array any - input set
b: array any - input set
return: array 1D any - array that includes all elements that are part of either A or B but not both A and B

## Usage

Use this to perform set operation "union - intersection"

## Location

menu: veeos ==> Math ==> Sets ==> setXOR

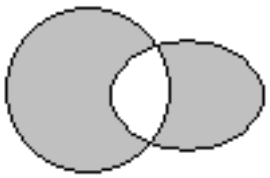
library: mathLib

## Example

o_setXOR( [2  3  4  3  5  5  3  1] ,  [6  3  4  7  1] ) returns [2  5  6  7]

## Notes

setXOR is equivalent to a union of two sets minus the intersection of those sets, as in the area of a Venn diagram outside of the intersecting area.



## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

isElement, setAND, setComplement, setOR, unique

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# SIGMA(FofN,from,thru)

*Evaluates the sum of a series.*


## Syntax

o_SIGMA(FofN,from,thru)
FofN: scalar Text - function to be evaluated with argument "n"
from: scalar number - lower limit of "n"
thru: scalar number - upper limit of "n"
return: numeric - the sum of terms F(n) for n=from through n=thru

## Usage

An arbitrary function of "n" can be evaluated for a series. This implements a standard "SIGMA" notation sum.

## Location

menu: veeos ==> Math ==> SIGMA

library: mathLib

## Example

o_SIGMA("n^2*(n-1)",3,5) = (9*2)+(16*3)+(25*4) = 166

## Notes

A very common operation for series is the sum of the various terms. This evaluates that product.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

VEEOS

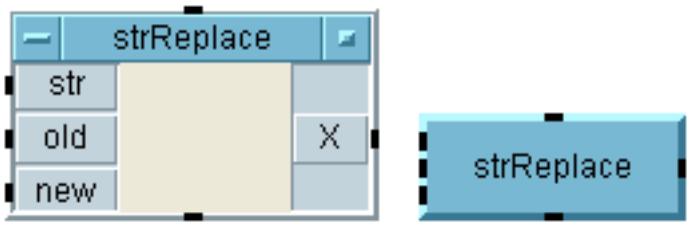
## See Also

PI

 Stan Bischof (stan@worldbadminton.com). Last updated 08 November 2015 20:10. 

# strReplace(str,old,new)

*Replaces occurrences of a target string within the input string.*




## Syntax

o_strReplace(str,old,new)
str: scalar Text - input string
old: scalar Text - target string
new: scalar Text - replacement string
return: Text with substituted string

## Usage

The input string is searched for the target string. When found the replacement string is inserted in place of the target string. The resulting string is then processed in the same way until target string is no longer found.

## Location

menu: veeos ==> math ==> strReplace

library: mathLib

## Example

o_strReplace("I thunk this is an unterestung strung","un","in")

*returns* "I think this is an interesting string"

## Notes

This objects recursively looks through the string to find and replace strings. Hence it may be possible to have unintended results if one replacement triggers another. In the future may want to rewrite to take this into account.

## Reference

## Supported On

VEE 7.0+. All platforms.

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48.

# unique(a)

*Returns unique subset.*


## Syntax

o_unique(a)
a: array any - input set
return: array 1D any - array with all duplicated elements removed

## Usage

Use this to remove duplicate elements in an array.

## Location

menu: veeos ==> Math ==> Sets ==> unique

library: mathLib

## Example

o_unique( [2 3 4 3 5 5 3 1] ) returns [2 4 5 3 1]

## Notes

When dealing with sets it is often useful to remove duplicate entries. A typical case is when processing all elements individually and not wanting to perform the processing twice for a duplicated element. Note that in the case of duplicates, the *last* identical element is retained.

## Reference

## Dependencies

use isElement(set,element)

## Supported On

VEE 7.0+, all platforms

unique

## See Also

isElement, setAND, setComplement, setOR, setXOR

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# netLib

*Functions that use the internet.*

## Functions

- longLat - *returns the longitude and latitude for a given city*
- currentTemp - *returns the current temperature for a given city*
- currentHumidity - *returns the current humidity for a given city*

## Internal Content

*These are used within the library but can often be useful directly accessed from without.*

- private functions
  - version - returns revision date of this library
- variables
  *none*

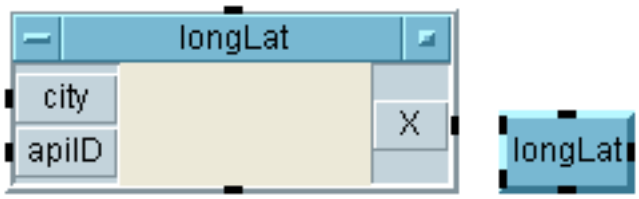
## Standalone Objects

## Notes

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# longLat(city,apiID)

*Returns the longitude and latitude for a given city*




## Syntax

o_longLat(city,apiID)
city: scalar Text - name of city
apiID: scalar text - API ID from website
return: coord - longitude and latitude

## Usage

Queries the web for longitude and latitude coordinates. City can be specified by full name, or for the USA, by zip code.

## Location

menu: veeos ==> Web ==> longLat

library: netLib

## Example

## Notes

This function takes advantage of the published API from openweathermap.org. Obtain your user ID by registering with openweathermap. The ID is free and will be usable for all API calls from openweathermap.org. Since this depends upon web services and the concomitant network connectivity, plus potential non-availability of specific location data, expect occasional intermittent behavior.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

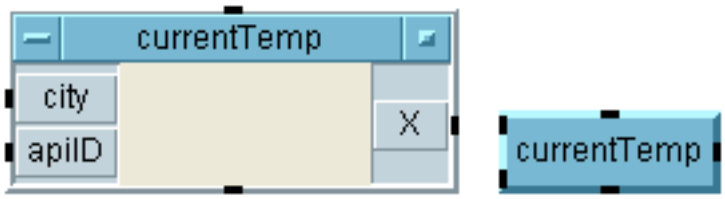
## See Also

currentHumidity, currentTemp

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# currentTemp(city,apiID)

*Returns the current temperature for a given city*




## Syntax

o_currentTemp(city)
city: scalar Text - name of city
apiID: scalar text - API ID from website
return: real - temperature in deg F

## Usage

Queries the web for current temperature. City can be specified by full name, or for the USA, by zip code.

## Location

menu: veeos ==> web ==> currentTemp

library: netLib

## Example

## Notes

This function takes advantage of the published API from openweathermap.org. Obtain your user ID by registering with openweathermap. The ID is free and will be usable for all API calls from openweathermap.org. Since this depends upon web services and the concomitant network connectivity, plus potential non-availability of specific location data, expect occasional intermittent behavior.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

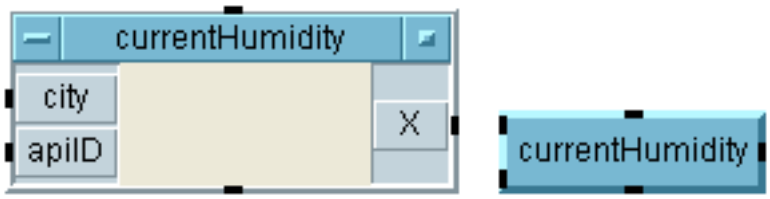
currenttemp

longLat, currentTemp

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# currentHumidity(city,apiID)

*Returns the current humidity for a given city*




## Syntax

o_currentTemp(city)
city: scalar Text - name of city
apiID: scalar text - API ID from website
return: real - relative humidity in %

## Usage

Queries the web for current humidity. City can be specified by full name, or for the USA, by zip code.

## Location

menu: veeos ==> web ==> currentHumidity

library: netLib

## Example

## Notes

This function takes advantage of the published API from openweathermap.org. Obtain your user ID by registering with openweathermap. The ID is free and will be usable for all API calls from openweathermap.org. Since this depends upon web services and the concomitant network connectivity, plus potential non-availability of specific location data, expect occasional intermittent behavior.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

longLat, currentTemp

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# sigLib

*Signal Processing Components*

## Functions

- dcBlock - *removes the DC component of a signal*
- decayFilter - *Implements a filter whose response is based on a given decay rate.*
- dutyCycle - *Determines the duty cycle of an arbitrary signal*
- envelope - *Constructs an envelope for arbitrary signals.*
- fallTime - *Determines the fall time of an arbitrary signal*
- frequency - *Determines the dominant frequency of an arbitrary signal.*
- funcFilter - *Implements an analog filter with transfer response specified by an arbitrary function.*
- period - *Determines the period of an arbitrary signal.*
- polyFilter - *Implements an analog filter with transfer response specified by numerator and denominator polynomials.*
- riseTime - *Determines the rise time of an arbitrary signal*
- rootFilter - *Implements an analog filter with transfer response specified by poles and zeroes.*

## Internal Content

*These are used within the library but can often be useful directly accessed from without.*

- private functions
    - aAmp - *generic analog amplifier*
    - aFilter - *generic classical analog filter*
    - aMixer - *generic analog mixer*
    - aRectifier - *generic analog rectifier*
    - butterPoly - *generates Butterworth polynomials*
    - chebyPoly - *generates Chebychev polynomials*
    - version - returns revision date of this library
- variables
  *none*

## Standalone Objects

- analogAmp - *configurable analog amplifier*
- analogFilter - *configurable analog classical filter*
- downConvert - *mixer-based down-conversion object*
- negBridge - *An ideal negative polarity full-wave rectifier.*
- negRectifier - *An ideal negative polarity half-wave rectifier.*
- posBridge - *An ideal positive polarity full-wave rectifier.*
- posRectifier - *An ideal positive polarity half-wave rectifier.*
- upConvert - *mixer-based up-conversion object*

## Notes

Since VEE was originally designed as a Signal Processing toolbench, it has many capabilities in that area that have been mostly neglected over the years. These signal processing components are designed to encourage quick and easy nonlinear signal analysis, generally in near-real-time, that in

many cases is far simpler than using common circuit analysis tools. As with circuit tools, VEE circuits are strung together using components with more-or-less direct real world analogs, but without the often-complicated setup and batch processing that comes with circuit analysis tools. Given this, VEE can also be extended to incorporate circuit analysis tools in a way that hides them from the end user, ending up with the full power of circuit analysis but with the ease-of-use of graphical programming.

 Stan Bischof (stan@worldbadminton.com). Last updated 10 November 2015 21:06. 

# dcBlock(a)

*Removes the DC component of a signal.*


## Syntax

o_dcBlock(a)

a: waveform - input signal
return: waveform - same signal but with the DC component removed

## Usage

Use wherever a DC block would normally be required in a circuit. Typical use is to isolate bias voltages or to protect sensitive inputs.

## Location

menu: veeos ==> Signal processing ==> Devices ==> dcBlock

library: sigLib

## Example

## Notes

A classical DC block is in practice usually implemented as a low-leakage series capacitor. As such it always has a lower frequency cutoff due to the finite capacitance and a a higher frequency cutoff due to the physical size and concomitant resonances that occur. In this case the dcBlock is implemented mathematically so is ideal, having none of the limitations of a capacitor.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

negBridge, posBridge, negRectifier, posRectifier

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# decayFilter(a,decayRate)

*Implements a filter whose response is based on a given decay rate.*


## Syntax

o_decayFilter(a,decayRate)
a: waveform - input waveform
decayRate: numeric - decay rate in percentage
return: waveform- input transformed by the decay-based filter

## Usage

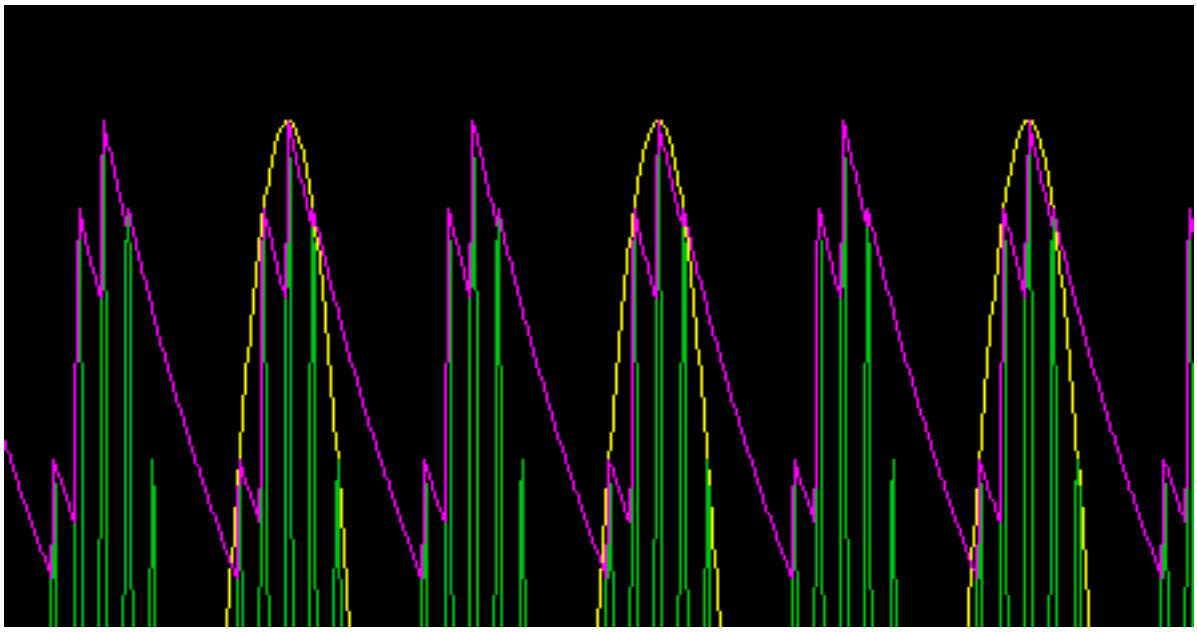
Typical usage is to model a diode-RC detector, but can be used in any case where the output signal is a decayed version of the input signal.

## Location

menu: veeos ==> Signal processing ==> Modules ==> decayFilter

library: sigLib

## Example



## Notes

A very basic nonlinear filter can be implemented with a diode and a capacitor. The capacitor provides charge storage (i.e. memory) and the diode provides charges to the capacitor in one direction only (i.e. charges cap but doesn't discharge it). This provides a non-linear filter such that it follows a rising input but the output decays at a specified rate(so-called slew rate). A typical use for this is for recovering an envelope from an AM-modulated signal.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

analogFilter, envelope

# dutyCycle(a)

*Determines the duty cycle of an arbitrary signal.*


## Syntax

o_dutyCycle(a)

a: waveform - signal to be analyzed
return: scalar Real- duty cycle of the (presumed) periodic signal

## Usage

Returns the duty cycle of a signal, as defined by 10-90 transitions between a "high" and "low" value.

## Location

menu: veeos ==> Signal Processing ==> dutyCycle

library: sigLib

## Example

*see example in veeos menu*

## Notes

One common parameter for digital signals is duty cycle: the relative time spent "high" vs "low". This is normally presented as a ratio, with "1" being "high all the time and "0" being "low all the time". This function uses that standard and defines "up" as within 10% of highest value and "down" as within 10% of the lowest value. Given these margins the function is resistant to noise in the signal, but of course gets best results with many cycles.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

dutyCycle

## See Also

fallTime, frequency, period, riseTime

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# envelope(a,opt)

*Constructs an envelope for arbitrary signals.*





## Syntax

o_envelope(a,opt)
a: shape type - description
opt: scalar int- options: method 1: **0** for maxima, **1** for minima
method 2: **2** for maxima, **3** for minima
return: type - coordinates of the envelope

## Usage

The envelope of a a signal is a line tracing the extreme points of the signal. Typically this represents a modulation signal on a carrier.

*NOTE: use Method 1 for clean signals and Method 2 for noisy signals or when Method 1 fails..*

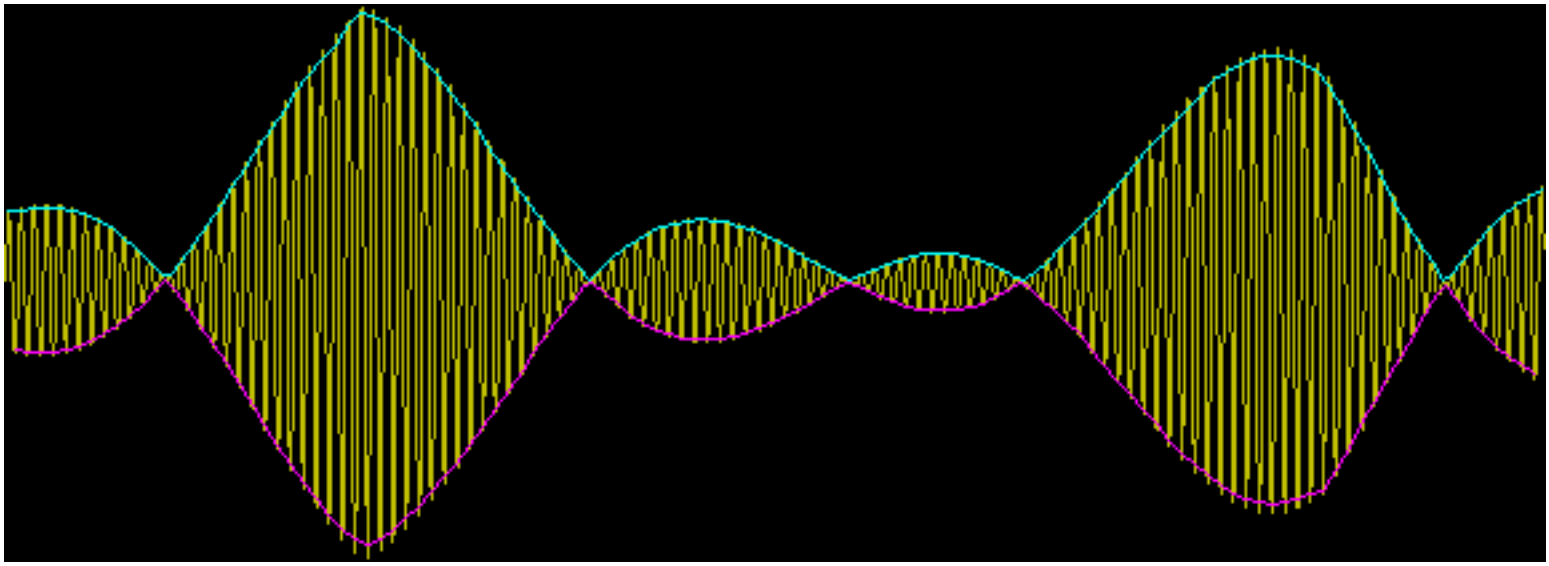
## Location

menu: veeos ==> Signal Processing ==> envelope

library: sigLib

## Example

*See veeos examples . Typical signal and envelope are shown here:*



o_envelope(A,3) returns minima using Method 2
o_envelope(A,0) returns maxima using Method 1

## Notes

In a typical communication signal, a high frequency (carrier is) modulated by a low frequency (baseband) signal. The baseband signal contains the information to be sent and the carrier is chosen for transmission characteristics. Once modulated the baseband signal itself no longer exists, but rather it is represented by the fluctuations in the carrier. If specific assumptions are made for the modulated signal, then the baseband can be determined by basic signal processing. However for more complex signals- say a chirped carrier or freq hopping carrier- without specific information reconstructing the baseband can be very difficult. This function assumes nothing about the signal but instead looks directly at the time domain signal and ferrets out local extrema as best as it can.

To methods are available in this function, selected by option value

Method 1 uses derivatives so is fragile when it comes to noise but also gives a very good estimate of correct peaks.

Method 2 is more brute force and is quite noise-tolerant.

Another alternative that may give better results for some signals is decayFilter() which has its own issues but will not fail and is what is commonly used in the real world.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

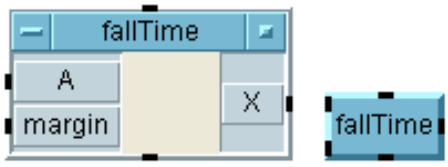
## See Also

decayFilter

 Stan Bischof (stan@worldbadminton.com). Last updated 11 November 2015 10:32. 

# fallTime(a,margin)

*Determines the fall time of an arbitrary signal*




## Syntax

o_fallTime(a,margin)

a: waveform - signal to be analyzed
margin: scalar numeric - margin to be used for fall time, in percent
return: scalar Real- fall time of signal

## Usage

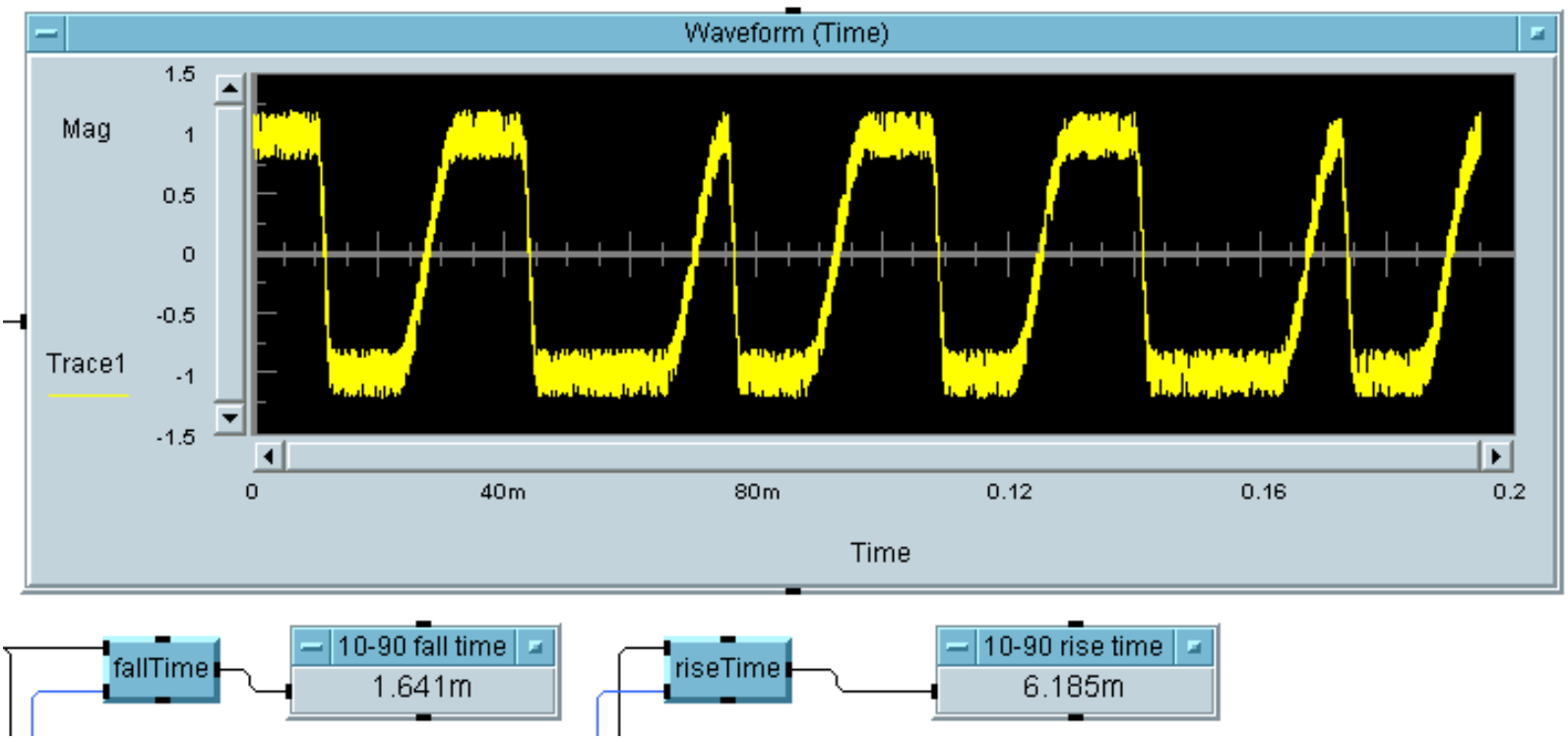
One common parameter for digital signals (pulses, square waves, etc.) is fall time. Fall time is the transition time from a lower extreme to an upper extreme. This is commonly defined as 10-90 time (time from 10% of the full transition to 90%) or 20-80 fall time. This function takes an arbitrary signal and analyzes it to determine the average fall time. The input *margin* is used to define both the upper and lower transition limits. Hence margin=10 is the same as 10-90 fall time.

## Location

menu: veeos ==> Signal Processing ==> fallTime

library: sigLib

## Example




## Notes

This function is very general in nature so any signal may be used. It finds all applicable transitions in the given signal and then averages them to give an estimate of the signal's fall time. Note that it does not treat any particular fall time as more important than any other so if you are looking for transitions in very noisy signals you may want to examine the signal differently. Since *margin* can be specified you are free to define fall as you like.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

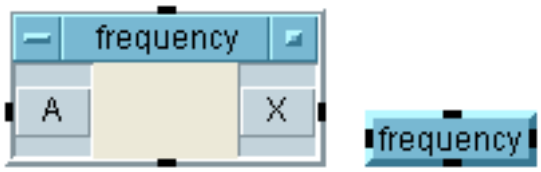
## See Also

dutyCycle, frequency, period, riseTime,

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# frequency(a)

*Determines the dominant frequency of an arbitrary signal.*







## Syntax

o_frequency(a)

a: waveform - signal to be analyzed
return: scalar Real- frequency of the (presumed) periodic signal

## Usage

Think of this as a noise-resistant frequency counter. It examines the signal and returns a representative frequency for the signal.

## Location

menu: veeos ==> Signal Processing ==> frequency

library: sigLib

## Example

*see examples in veeos menu*

## Notes

One common parameter for periodic signals is frequency. This is generally the dominant frequency and can be determined by various methods. This function looks at the spectrum and determines the peak. As such it is very tolerant to noise. For amplitude modulated signals this will give a better frequency estimate than using 1/period since the latter may well see the modulation rather than the carrier.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

frequency

dutyCycle, fallTime, period, riseTime

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# funcFilter(a,Hs)

*Implements an analog filter with transfer response specified by an arbitrary function.*


## Syntax

o_funcFilter(aHs)

a: Waveform or Spectrum - inputSignal
Hs: scalar Text - any function with argument "s"
return: Waveform or Spectrum - output signal formed by passing through the filter defined by Hs

## Usage

Analog filters are generally specified by a rational polynomial. However there's no reason why this can't be generalized by allowing most any transfer function H(s). Use this filter for when you would like to use any H(s).

## Location

menu: veeos ==> Signal Processing ==> Modules ==> funcFilter

library: sigLib

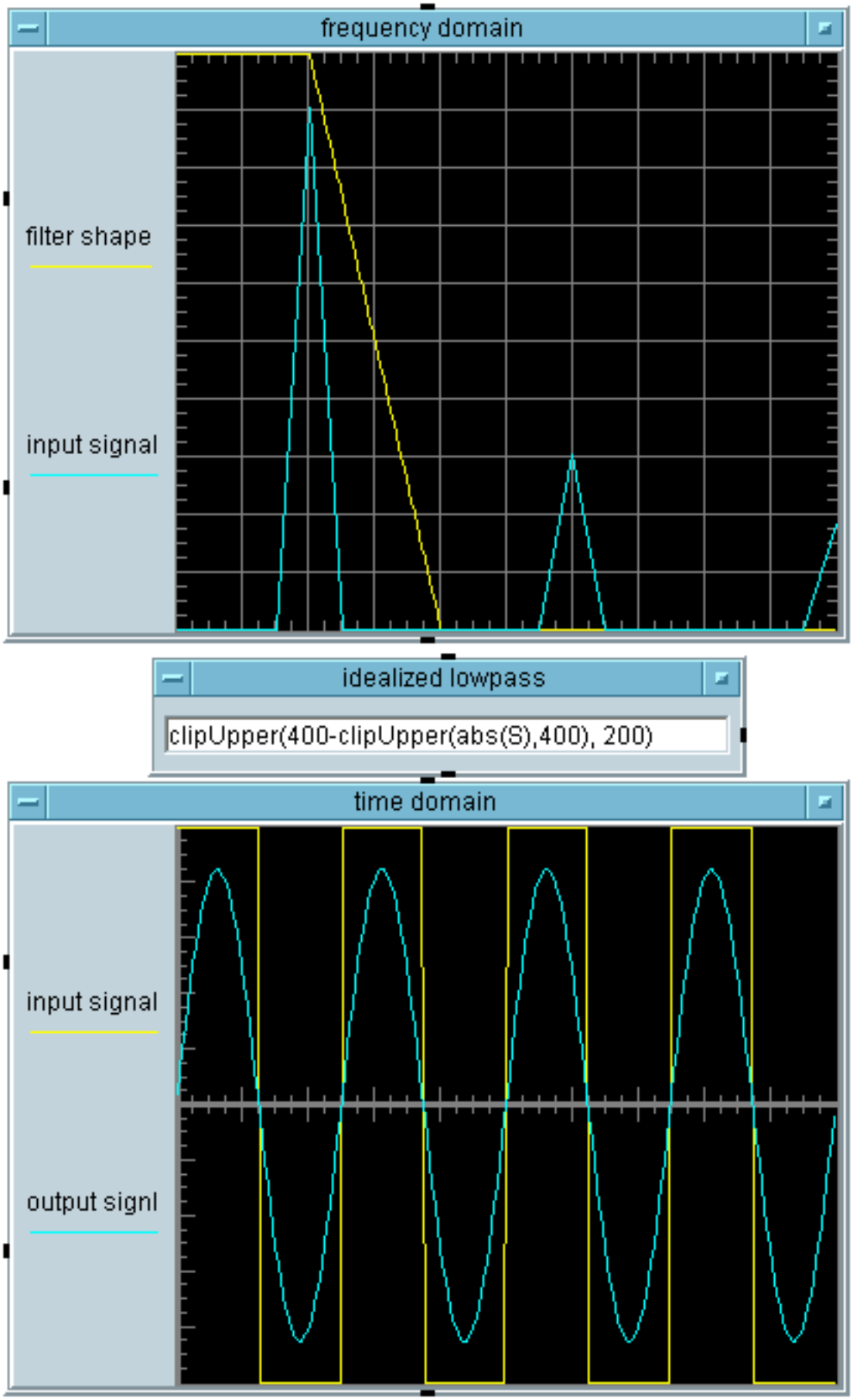
## Example

Brickwall filter: The ultimate lowpass filter would remove all frequencies above a given limit. This is not realizable (is the limit of an infinite number of elements) but can certainly be modeled. For instance

H(s) = ( im(s) < 450 ? 1 : 0 )  would remove everything above 450Hz and allow everything below it to pass unimpeded

Phase shift: a pure phase shift is also not achievable in the real world except for at  single frequency, but in the mathematical world is quite doable. In this case

H(s) = exp( S )  shifts the phase of everything by 90 degrees ( e^s becomes e^jF and hence 90 degree shift ).


frequency domain
filter shape
input signal
idealized lowpass
clipUpper(400-clipUpper(abs(S),400), 200)
time domain
input signal
output signl

## Notes

Rational polynomials are used for a very good reason to define filters: they are guaranteed to be stable (if poles are in LHP) , causal, and physically realizable. However there's nothing that says one can't use most any function to define the frequency response.

NOTE that the transfer function H(s) has a complex argument and that this filter filter operates on the jF axis (real frequencies) so any function that you write must be valid for complex numbers. Since some VEE functions do not support complex arguments you do need to be a little careful here.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

aFilter, AnalogFilter, rootFilter, funcFilter

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# period(a)

*Determines the period of an arbitrary signal.*


## Syntax

o_period(a)
a: waveform - signal to be analyzed
return: scalar Real- period of the (presumed) periodic signal

## Usage

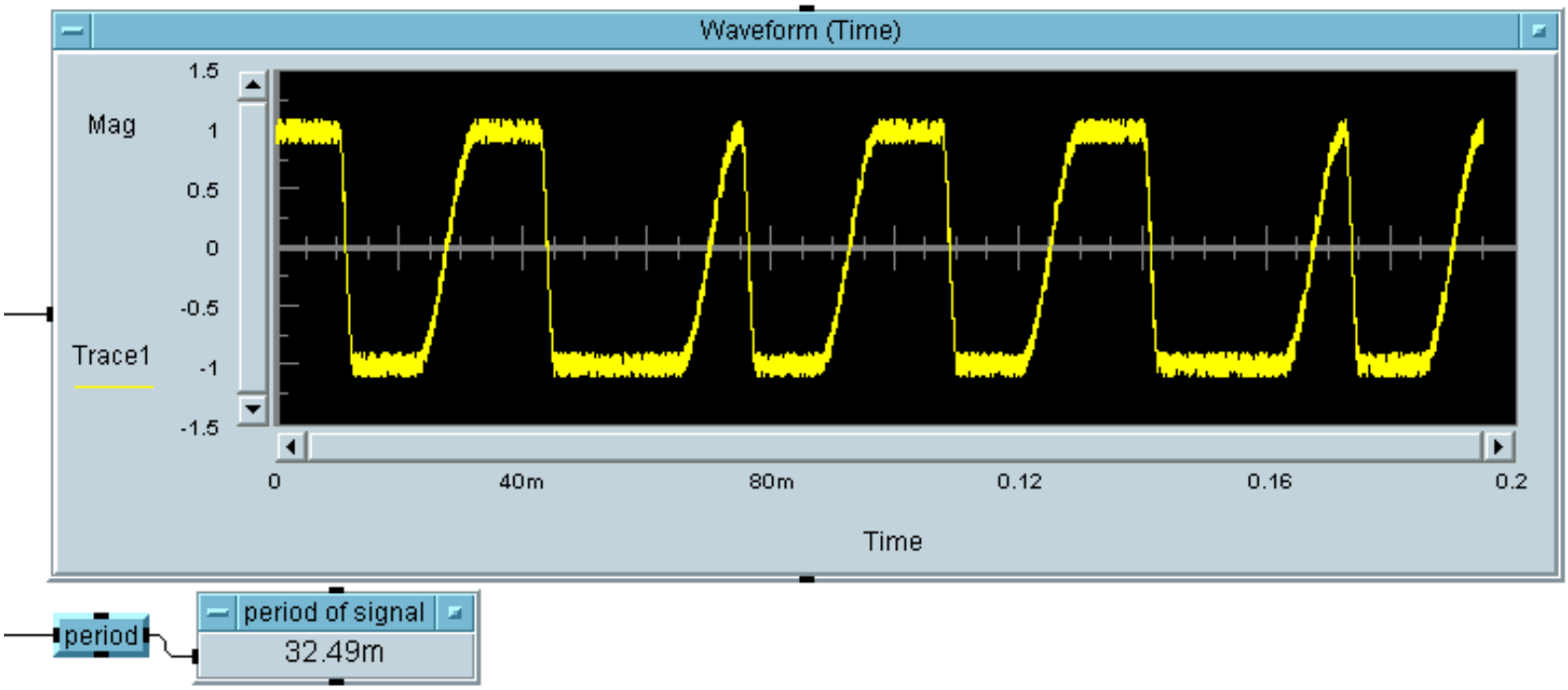
One common parameter for digital signals (pulses, square waves, etc.) is period. Period is the time between successive transitions of the signal.This function takes an arbitrary signal and analyzes it to determine the average period.

## Location

menu: veeos ==> Signal Processing ==> period

library: sigLib

## Example




## Notes

This function is very general in nature so any signal may be used. It finds all applicable times between transitions in the given signal and then averages them to give an estimate of the signal's period. This function defines transitions as 10-90% so can handle a fair amount of noise in the signal. However, also note that this function would not be suitable for amplitude modulated signals.

period

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

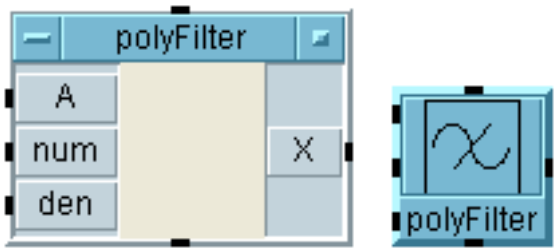
## See Also

fallTime, frequency, riseTime

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# polyFilter(a,num,den)

*Implements an analog filter with transfer response specified by numerator and denominator polynomials.*




## Syntax

o_polyFilter(a,num,den)

a: Waveform or Spectrum - inputSignal
num: array 1D numeric - coefficients of numerator polynomial (0 thru n)
den: array 1D numeric - coefficients of denominator polynomial (0 thru n)
return: Waveform or Spectrum - output signal formed by passing through defined filter

## Usage

Analog filters are generally specified by a rational polynomial. Use this filter when you know the coefficients of the defining polynomial.

## Location

menu: veeos ==> Signal Processing ==> Modules ==> polyFilter

library: sigLib

## Example

*see example in veeos menu*

## Notes

In general a linear (analog) filter may be defined by the rational polynomial H(S) where Output(S)=Input(S)*H(S). A typical H(S) rational polynomial may be expressed as:
( n[0]*S^0 + n[1]*S^1 +...n[i]*S^i  ) / ( p[0]*S^0 + p[1]*S^1 +...p[i]*S^i )

where *n* and *p* are the coefficient vectors that define these polynomials. This function inputs those two vectors, determines H(jF), and filters the input signal appropriately.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

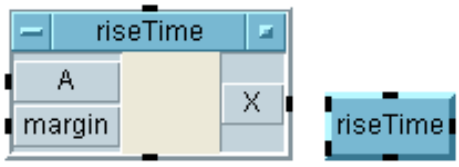
## See Also

aFilter, AnalogFilter, funcFilter, rootFilter

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:49. 

# riseTime(a,margin)

*Determines the rise time of an arbitrary signal.*




## Syntax

o_riseTime(a,margin)

a: waveform - signal to be analyzed
margin: scalar numeric - margin to be used for rise time, in percent
return: scalar Real- rise time of signal

## Usage

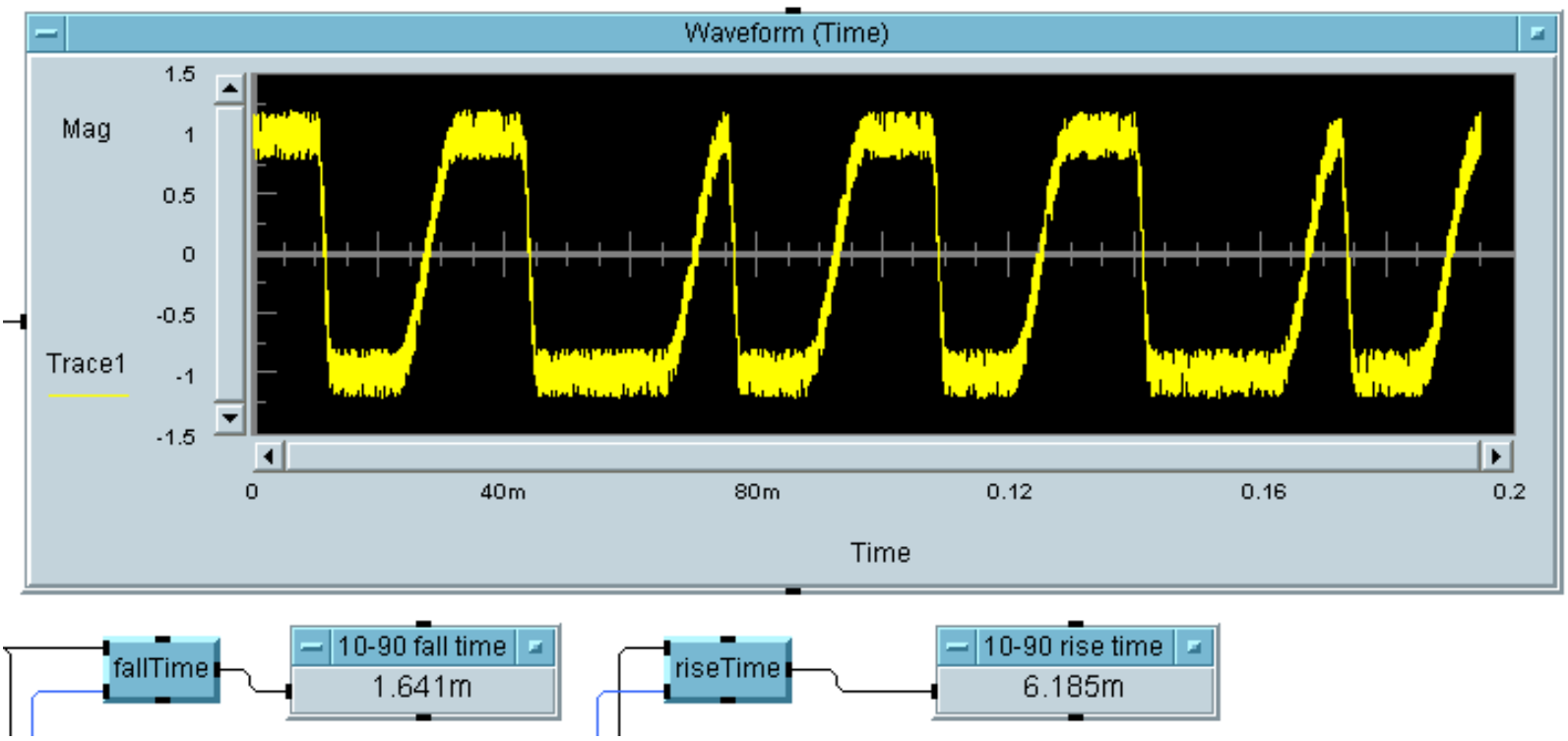
One common parameter for digital signals (pulses, square waves, etc.) is rise time. Rise time is the transition time from a lower extreme to an upper extreme. This is commonly defined as 10-90 time (time from 10% of the full transition to 90%) or 20-80 rise time. This function takes an arbitrary signal and analyzes it to determine the average rise time. The input *margin* is used to define both the upper and lower transition limits. Hence margin=10 is the same as 10-90 rise time.

## Location

menu: veeos ==> Signal Processing ==> riseTime

library: sigLib

## Example




## Notes

This function is very general in nature so any signal may be used. It finds all applicable transitions in the given signal and then averages them to give an estimate of the signal's rise time. Note that it does not treat any particular rise time as more important than any other so if you are looking for transitions in very noisy signals you may want to examine the signal differently. Since *margin* can be specified you are free to define rise as you like.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

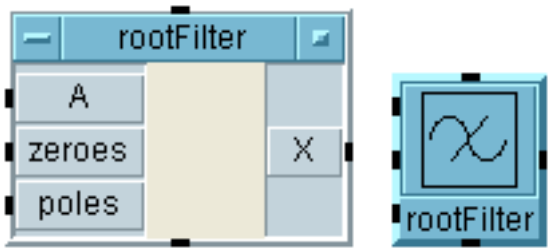
## See Also

dutyCycle, fallTime, frequency, period

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# rootFilter(a,zeroes,poles)

*Implements an analog filter with transfer response specified by poles and zeroes.*




## Syntax

o_rootFilter(a,zeroes,poles)

a: Waveform or Spectrum - inputSignal
zeroes: array 1D Complex - zeroes of numerator polynomial
poles: array 1D Complex - zeroes of denominator polynomial
return: Waveform or Spectrum - output signal formed by passing through defined filter

## Usage

Analog filters are generally specified by a rational polynomial. Use this filter when you know the roots (zeroes and poles) of the defining polynomial.

## Location

menu: veeos ==> Signal Processing ==> Modules ==> rootFilter

library: sigLib

## Example

*see example in veeos menu*

## Notes

In general a linear (analog) filter may be defined by the rational polynomial H(S) where Output(S)=Input(S)*H(S). A typical H(S) rational polynomial may be expressed as:
( (S-z[0])*(S-z[1])*...(S-z[i])  ) / ( (S-p[0])*(S-p[1])*...(S-p[i]) )

where *z* and *p* are the roots of the numerator and denominator polynomials. This function inputs those two vectors, determines H(jF), and filters the input signal appropriately.

If you have a zeroes at infinity then the numerator will be just a constant. In this case you may be better off using polyFilter. However, perhaps you really do want to work with the poles separately, in which case you can still proceed by noting that the polynomial has factors of the form (S-z[0]) and that you are free to specify anything you like for z[0]. In this case you can, for instance, choose z[0] = "S-67" so that S-z[0] becomes S-S

+67 or just 67.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

aFilter, AnalogFilter, funcFilter, rootFilter

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# aAmp(a,specs)

*Generic analog amplifier*

*Function only- no corresponding object*

## Syntax

o_aAmp(a,specs)
a: Waveform - input signal
specs: scalar Record - record that sets specs for the amplifier
3 fields: gain in dB, upperClip, lowerClip
return: Waveform - output signal

## Usage

Drop this in to model an idealized non-linear amplifier with saturation.

## Location

menu: *no menu pick - to access use the Function and Object browser*

library: sigLib

## Example

## Notes

This implements a mathematically ideal saturating amplifier. Saturation is taken as a hard limit. It is normally hidden behind analogAmp, providing the needed functionality, but can also be used standalone.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

aFilter, aMixer

# aFilter(a,specs)

*Generic classical analog filter*

*Function only- no corresponding object*

## Syntax

o_aFilter(a,specs)
a: shape type - description
b: shape type - description
return: type - description

## Usage

## Location

menu: *no menu pick - to access use the Function and Object browser*

library: funcLib

## Example

## Notes

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

aAmp, aFilter, aMixer, polyFilter, rootFilter

# aMixer(a,b,specs)

*Generic analog mixer*

*Function only- no corresponding object*

## Syntax

o_aMixer(a,b,specs)
a: Waveform - input signal 1
b: Waveform - input signal 2
specs: scalar Record - specifies behavior
fields: cl (conversion loss in dB), AXi (A signal isolation in dB), BXi (B signal isolation in dB)
return: Waveform - the result of mixing the two input signals and adding in leakage.

## Usage

## Location

menu: *no menu pick - to access use the Function and Object browser*

library: sigLib

## Example

## Notes

This implements a mathematically ideal mixer with the addition of leakage signals. It is normally hidden behind upConvert and downConvert, providing the needed functionality, but can also be used standalone.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

aAmp, aFilter

# aRectifier(a,specs)

*Generic analog rectifier*

*Function only- no corresponding object*

## Syntax

o_aRectifier(a,specs)
a: shape type - description
b: shape type - description
return: type - description

## Usage

## Location

menu: *no menu pick - to access use the Function and Object browser*

library: sigLib

## Example

## Notes

## Reference

## Dependencies

## Supported On

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:31. 

# butterPoly(specs)

*Generates Butterworth polynomials*

*Function only- no corresponding object*

## Syntax

o_butterPoly(specs)
specs: scalar record with fields:
function: enum (HP,BP,LP,BS)
Fl: scalar Real - lower cutoff frequency
Fu: scalar Real - upper cutoff frequency
return: Text - polynomial in S

## Usage

Given frequency specs this calculates a polynomial that is intended to be placed in a formula to generate a frequency domain transfer function. That way signals can be passed through this formula at will.

## Location

menu: *no menu pick - to access use the Function and Object browser*

library: sigLib

## Example

Given LP function, Fu=100, 3rd order, the resulting polynomial transfer function in S is:

(-1*(-49.99999999999999, 86.60254037844388)*-1*(-100, 6.123031769111886E-015)*-1*(-49.99999999999999, -86.60254037844388))/((S-(-49.99999999999999, 86.60254037844388))*(S-(-100, 6.123031769111886E-015))*(S-(-49.99999999999999, -86.60254037844388)))

## Notes

## Reference

## Dependencies

## Supported On

## See Also

chebyPoly

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:31. 

# chebyPoly(specs)

*Generates Checbychev polynomials*

*Function only- no corresponding object*

## Syntax

o_chebyPoly(specs)
specs: scalar record with fields:
function: enum (HP,BP,LP,BS)
Fl: scalar Real - lower cutoff frequency
Fu: scalar Real - upper cutoff frequency
Pr: scalar Real - passband ripple
return: Text - polynomial in S

## Usage

Given frequency specs this calculates a polynomial that is intended to be placed in a formula to generate a frequency domain transfer function. That way signals can be passed through this formula at will.

## Location

menu: *no menu pick - to access use the Function and Object browser*

library: sigLib

## Example

Given LP function, Fu=100, 35th order, , 1dB ripple, the resulting polynomial transfer function in S is:

(-1*(-8.945836220019011, 99.01071120033895)*-1*(-23.42050328179965, 61.19198477210937)*-1*(-28.94933412356129, 6.374444838711282E-015)*-1*(-23.42050328179965, -61.19198477210936)*-1*(-8.945836220019015, -99.01071120033895))/((S-(-8.945836220019011, 99.01071120033895))*(S-(-23.42050328179965, 61.19198477210937))*(S-(-28.94933412356129, 6.374444838711282E-015))*(S-(-23.42050328179965, -61.19198477210936))*(S-(-8.945836220019015, -99.01071120033895)))

## Notes

## Reference

## Dependencies

## Supported On

## See Also

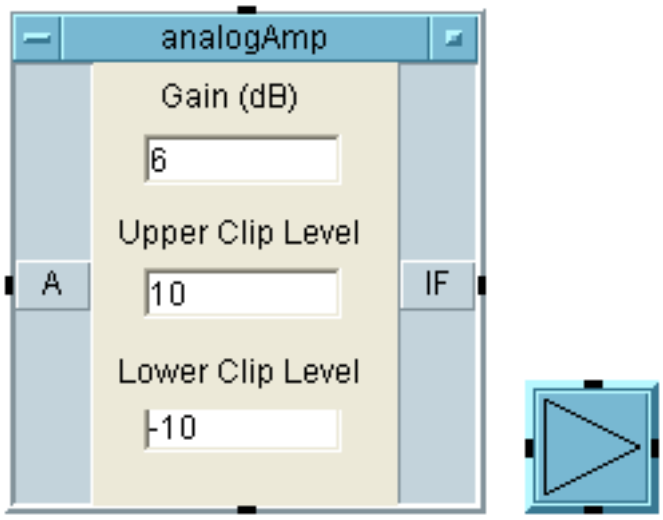
chebyPoly

butterPoly

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

# analogAmp

*A generic configurable nonlinear amplifier*




## Syntax

*None- object only.*

## Usage

Use this to simulate an idealized saturating amplifier.

## Location

menu: veeos ==> Signal Processing ==> Modules ==> analogAmp

library: sigLib

## Example

*See veeos examples*

## Notes

This implements a mathematically ideal saturating amplifier. Saturation is taken as a hard limit.

## Reference

## Dependencies

Underlying function is aAmp.

## Supported On

VEE 7.0+, all platforms

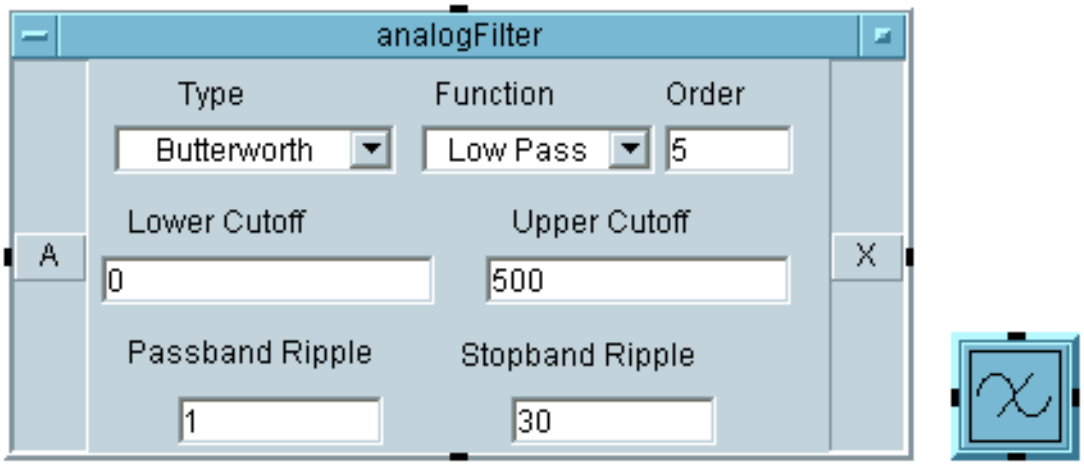
## See Also

analogFilter, downConvert, upConvert

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# analogFilter

*Configurable analog classical filter.*




### Syntax

*None- object only.*

### Usage

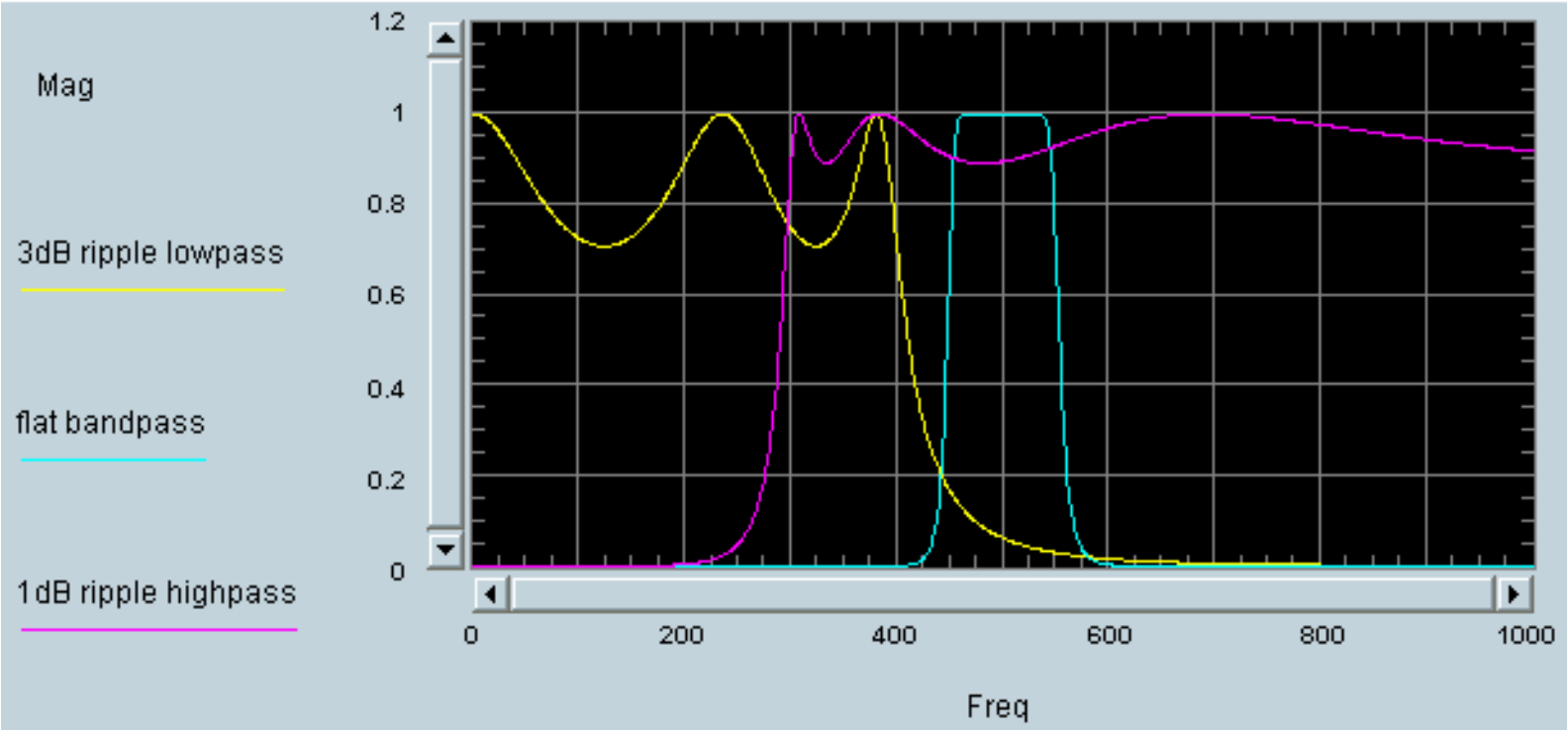
Drop this down in order to implement analog filtering on a signal. Filter type, order, cutoff and so on are configurable.

### Location

menu: veeos ==> Signal Processing ==> Modules ==> analogFilter

library: sigLib

### Example




## Notes

This object is a wrapper around the aFilter function which does the actual work. The wrapper provides an easy way to make sure that the configuration inputs of aFilter are valid. In operation, the signal is converted to frequency domain and then multiplied by the transfer function defined by the chosen filter specifications.

## Reference

The filters implemented include the classical polynomial definitions of Chebychev (equal ripple) and Butterworth (maximally flat) filters.

## Dependencies

Uses aFilter which in turn requires ButterPoly and ChebyPoly

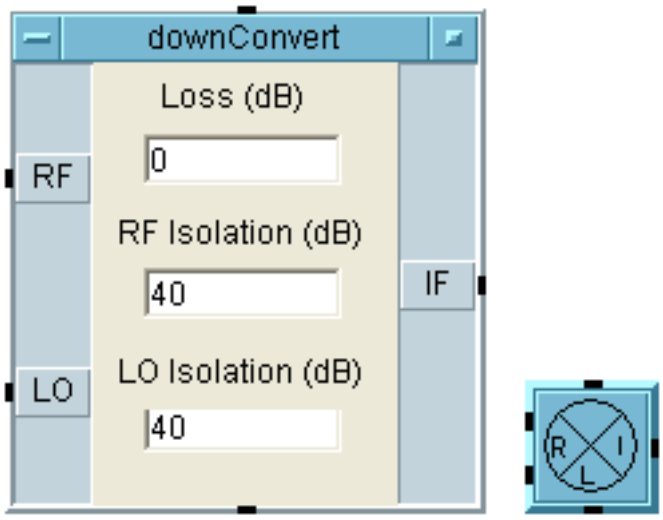
## Supported On

## See Also

analogAmp, downConvert, upConvert, decayFilter, polyFilter, rootFilter

# downConvert

*Mixer-based down-conversion object*




## Syntax

*None- object only.*

## Usage

Use this to mix two signals together in a down-converter configuration, translating an RF frequency to a lower IF frequency by mixing with an LO. Note that RF-IF and LO-IF isolation may be specified.

## Location

menu: veeos ==> Signal Processing ==> Modules ==> downConvert

library: sigLib

## Example

## Notes

In communications it is very common to place a baseband signal on carrier that is at much higher frequency than the baseband. This allows the broadband baseband signal to be treated as a narrowband signal, moves it to a convenient frequency for transmission and allows many other possible processing steps. Conversely it is common to reverse this up-conversion with a down-conversion to retrieve the original baseband signal. This object uses a mixer to mathematically model such frequency conversion. Note that while lekage is allowed within the model, it is not specifically accounted for as higher-level mixing products.

## Reference

Any basic communications text will talk about this subject.

## Dependencies

Uses aMixer to simulate the actual mixing action.

## Supported On

VEE 7.0+, all platforms

## See Also

analogAmp, analogFilter, upConvert

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# negBridge

*An ideal negative polarity full-wave rectifier.*

## Syntax

*none - object only*

## Usage

To simulate a full-wave rectifier.

## Location

menu: veeos ==> Signal processing ==> Devices ==>negBridge

library: sigLib

## Example

## Notes

In a real world circuit, a full-wave rectifier is typically produced by using a transformer and a bridge configuration of 4 diodes. This effectively allows negative going signals through untouched and inverts positive-going signals so that all outputs are the same polarity. When used for power supplies or signal recovery, the full-wave rectifier is more complex than a half wave rectifier but at the same time is far more efficient since all of the signal passes through.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

dcBlock, posBridge, negRectifier, posRectifier

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# negRectifier

*An ideal positive negative half-wave rectifier.*

## Syntax

*none - object only*

## Usage

To simulate a half-wave rectifier.

## Location

menu: veeos ==> Signal processing ==> Devices ==>negRectifier

library: sigLib

## Example

## Notes

In a real world circuit, a half-wave rectifier is typically produced by using a single diode. This effectively allows one polarity of signal to pass, but block the opposite polarity. When used for power supplies or signal recovery, the half-wave rectifier is very simple and cheap to implement, but is less efficient than a full-wave rectifier since half of the signal is blocked.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

dcBlock, negBridge, posBridge, posRectifier

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# posBridge

*An ideal positive polarity full-wave rectifier.*

## Syntax

*None - object only*

## Usage

To simulate a full-wave rectifier.

## Location

menu: veeos ==> Signal processing ==> Devices ==>posBridge

library: sigLib

## Example

## Notes

In a real world circuit, a full-wave rectifier is typically produced by using a transformer and a bridge configuration of 4 diodes. This effectively allows positive going signals through untouched and inverts negative-going signals so that all outputs are the same polarity. When used for power supplies or signal recovery, the full-wave rectifier is more complex than a half wave rectifier but at the same time is far more efficient since all of the signal passes through.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

## See Also

dcBlock, negBridge, negRectifier, posRectifier

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# posRectifier

*An ideal positive polarity half-wave rectifier.*

## Syntax

*none - object only*

## Usage

To simulate a half-wave rectifier.

## Location

menu: veeos ==> Signal processing ==> Devices ==>negRectifier

library: sigLib

## Example

## Notes

In a real world circuit, a half-wave rectifier is typically produced by using a single diode. This effectively allows one polarity of signal to pass, but block the opposite polarity. When used for power supplies or signal recovery, the half-wave rectifier is very simple and cheap to implement, but is less efficient than a full-wave rectifier since half of the signal is blocked.

## Reference

## Dependencies

## Supported On

VEE 7.0+, all platforms

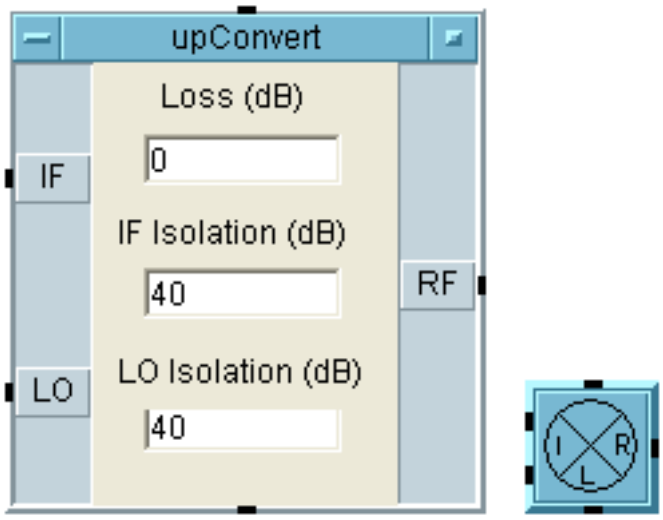
## See Also

dcBlock, negBridge, posBridge, negRectifier

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# upConvert

*Mixer-based up-conversion object*




## Syntax

*None- object only.*

## Usage

Use this to mix two signals together in a up-converter configuration, translating a baseband or IF frequency to a higher RF frequency by mixing with an LO. Note that RF-IF and LO-RF isolation may be specified.

## Location

menu: veeos ==> Signal Processing ==> Modules ==> upConvert

library: sigLib

## Example

## Notes

In communications it is very common to place a baseband signal on carrier that is at much higher frequency than the baseband. This allows the broadband baseband signal to be treated as a narrowband signal, moves it to a convenient frequency for transmission and allows many other possible processing steps. Conversely it is common to reverse this up-conversion with a down-conversion to retrieve the original baseband signal. This object uses a mixer to mathematically model such frequency conversion. Note that while lekage is allowed within the model, it is not specifically accounted for as higher-level mixing products.

## Reference

Any basic communications text will talk about this subject.

## Dependencies

Uses aMixer to simulate the actual mixing action.

## Supported On

VEE 7.0+, all platforms

## See Also

analogAmp, analogFilter, downConvert

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# sysLib

*Functions related to the operating system and the general computer environment.*

## Functions

- runInShell - *Runs specified code in a Windows shell*
- unzip - *Uses standard ZIP to unpack zip bundles.*
- uudecode - *Unpacks a coded ASCII file into the original format of the enclosed file.*
- uuencode - *Unpacks a coded ASCII file into the original format of the enclosed file.*
- winVersion - *Find the version of Windows which is currently running.*
- zip - *Uses standard ZIP to bundle whatever source files are specified.*

## Internal Content

*These are used within the library but can often be useful directly accessed from without.*

- private functions
  - version - returns revision date of this library
- variables
  *none*

## Standalone Objects

## Notes

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# runInShell(a)

*Runs specified code in a Windows shell*


## Syntax

o_runInShell(a)
a: scalar Text - full command line to execute
return: int - exit code

## Usage

Input needs to be the full command as you would enter it directly in a windows CMD shell. If spaces are included in path or file names, they need to be quoted.

## Location

menu: veeos ==> system ==> runInShell

library: sysLib

## Example

o_runInShell("copy C:\\temp\\somefile.txt C:\\temp\\newname.txt") uses the file system executable "copy" to copy the file somefile.txt to a new file newname.txt

## Notes

This function brings up a CMD shell, executes the given command line, and then exits (cmd /C option). The present working directory is used as the "working directory", so absolute paths are generally needed. This function provides a simple way to run programs from within a formula or other expression. If more flexibility is needed then use the underlying native VEE "Execute Program" object

## Reference

cmd options can be found via "help cmd" at a command prompt or can be found at Microsoft.

## Supported On

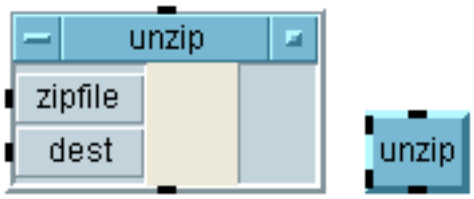
VEE 7.0+, Windows XP+

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# unzip(zipfile,dest)

*Uses standard ZIP to unpack zip bundles.*




## Syntax

o_unzip(zipfile,dest)
zipfile: scalar Text - zip file that is to be unpacked
dest: scalar Text - directory into which the zip file should be unpacked
return: none

## Usage

This uses the standard ZIP specification to unpack a zip file into the contained set of files and directories into a single package. Zip is a long time industry standard and is universally available.

## Location

menu: veeos ==> system ==> unzip

library: sysLib

## Example

o_unzip("C:\temp\veebackups.zip" , "C:\temp\" ) unpacks all of  veebackups.zip into the directory C:\temp.

## Notes

This function uses the present working directory as a reference so absolute paths are generally needed. Note that as with any unpackaging it is possible for this to inadvertently overwrite existing files. Hence be careful what you specify.

## Reference

- ZIP specification

## Supported On

VEE 7.0+, Windows XP+

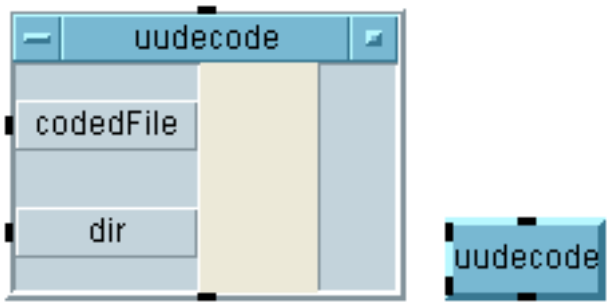
## See Also

zip, uudecode, uuencode

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# uudecode(codedFile,dir)

*Unpacks a coded ASCII file into the original format of the enclosed file.*




## Syntax

o_uudecode(codedFile,dir)
codedFile: scalar Text - the uuencoded file to be decoded
dir: scalar Text - the directory in which to place the file encoded within codedFile
return: none

## Usage

Uuencode/uudecode have been used for many decades to enable binary files to be placed within ASCII documents such as usenet forums or emails. By placing binary files as ASCII one can bypass virtually all filtering and ensure that the file arrives intact.

## Location

menu: veeos ==> system ==> uudecode

library: sysLib

## Example

o_uudecode("C:\temp\mydata.uue" , "C:\temp") unpacks whatever files was encoded into mydata.uue into the C:\temp directory

## Notes

Uuencode/uudecode use a very widespread and long-stable standard. Do not use spaces or other punctuation in file names for uuencoding

## Reference

- See Wikipedia for a discussion of the uuencode standard

## Supported On

uudecode

VEE 7.0+, Windows XP+

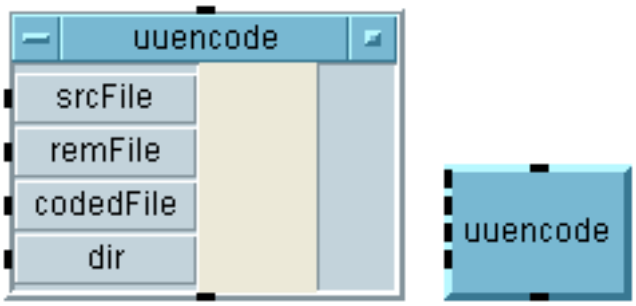
## See Also

zip, unzip, uuencode

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# uuencode(codedFile,dir)

*Unpacks a coded ASCII file into the original format of the enclosed file.*




## Syntax

o_uuencode(srcFile, remFile, codedFile, dir)
srcFile: scalar Text - the file that is to be encoded
remFile: scalar Text - the name under which srcFile will be called when it is decoded
codedFile: scalar Text - the file into which the encoded srcFile is to be placed
dir: scalar Text - the working directory to be used
return: none

## Usage

Uuencode/uudecode have been used for many decades to enable binary files to be placed within ASCII documents such as usenet forums or emails. By placing binary files as ASCII one can bypass virtually all filtering and ensure that the file arrives intact.

## Location

menu: veeos ==> system ==> uuencode

library: sysLib

## Example

uuencode("junk.dat", "dataFromStan.dat", "mydata.uue" , "C:\temp") cd's to the C:\temp directory and then encodes the file junk.dat into the package mydata.uue.

## Notes

Uuencode/uudecode use a very widespread and long-stable standard. Do not use spaces or other punctuation in file names for uuencoding.

## Reference

- See Wikipedia for a discussion of the uuencode standard

uuencode

## Supported On

VEE 7.0+, Windows XP+

## See Also

zip, unzip, uudecode

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# winVersion()

*Find the version of Windows which is currently running.*





## Syntax

o_winVersion()
return: record contains Windows version information including description, version name and service pack.

## Usage

This function queries the running Windows kernel for version information and then decodes it based on Windows standards.

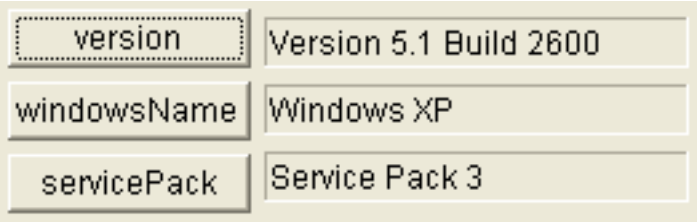
## Location

menu: Veeos ==> System ==> winVersion

library: sysLib

## Example

Running on XP/32 returns:




## Notes

This is an updated version of the code written and contributed to VRF by Georg Nied in 2003. In some cases there is an ambiguity since kernels are sometimes shared between versions. For instance, Windows XP 64 shares a kernel with Windows 2003 so this kernel query cannot distinguish between the two.

## Reference

- Windows version numbers are detailed by Microsoft.

## Supported On

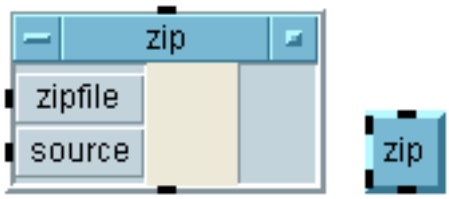
VEE 7.0+. Windows 3.1+

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# zip(zipfile,source)

*Uses standard ZIP to bundle whatever source files are specified.*




## Syntax

o_zip(zipfile,source)
zipfile: scalar Text - zip file that is to be created
source: scalar Text - list of file(s) that are to be added to the zip file
return: none

## Usage

This uses the standard ZIP specification to bundle an arbitrary set of files and directories into a single package. Zip is a long time industry standard and is universally available.

## Location

menu: veeos ==> system ==> zip

library: sysLib

## Example

o_zip("C:\temp\veebackups.zip" , "C:\temp*.bak" ) grabs all of the file in C:\temp that have a bak extension and bundles them into the file veebackups.zip.

## Notes

This function uses the present working directory as a reference so absolute paths are generally needed.

## Reference

- ZIP specification

## Supported On

VEE 7.0+, Windows XP+

zip

## See Also

unzip, uudecode, uuencode

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:49. 

# veeosLib

*Functions that didn't fit elsewhere or that help manage the library.*

## Functions

- time - *Converts timestamp to time of the day.*
- week - *Converts timestamp to week of the year.*
- downloadLatestLibrary - *Downloads the latest version the VEEOS library.*

## Internal Content

*These are used within the library but can often be useful directly accessed from without.*

- private functions
  - version - returns revision date of this library
- variables
  *none*

## Standalone Objects

- Help - *brings up a local copy of the online help in a popup window*

## Notes

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 

# time(aDate,option)

*Converts timestamp to time of the day.*


## Syntax

o_time(aDate, option)
aDate: scalar Timestamp
option: scalar Int - 0=12hr, 1=24hr, 2=seconds
return: Text

## Usage

Separates out the time alone from a given timestamp.

## Location

menu: veeos ==> misc ==> time

library: veeosLib

## Example

o_time(now(),0) returns the current time of day in 12 hour format

## Notes

VEE has built-in functions for day, month, year, but not time. This helps complete the set of Time/Date functions.

## Reference

## Supported On

VEE 7.0+, All platforms.

## See Also

week

time

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# week(aDate)

*Converts timestamp to week of the year.*


## Syntax

o_week(aDate)
aDate: scalar Timestamp
return: Int

## Usage

Determines the week of the year given specified timestamp.

## Location

menu: veeos ==> misc ==> week

library: veeosLib

## Example

o_week(now()) returns the current week of the year.

## Notes

VEE has built-in functions for day, month, year, but not time. This helps complete the set of Time/Date functions. Week in this case is defined by ISO-8601. Original version posted to VRF by Delmar Fryd in November 2012.

## Reference

- ISO-8601 is an international standard for time and date representation.

## Supported On

VEE 7.0+, All platforms.

## See Also

week

time

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:48. 

# downloadLatestLibrary()

*Downloads the latest version the VEEOS library.*


## Syntax

o_downloadLatestLibrary()
no inputs
return: byte array - zip file

## Usage

Finds and downloads the latest version of the VEEOS library. This is a zip file so save it wherever you like using To File object with BINARY write.

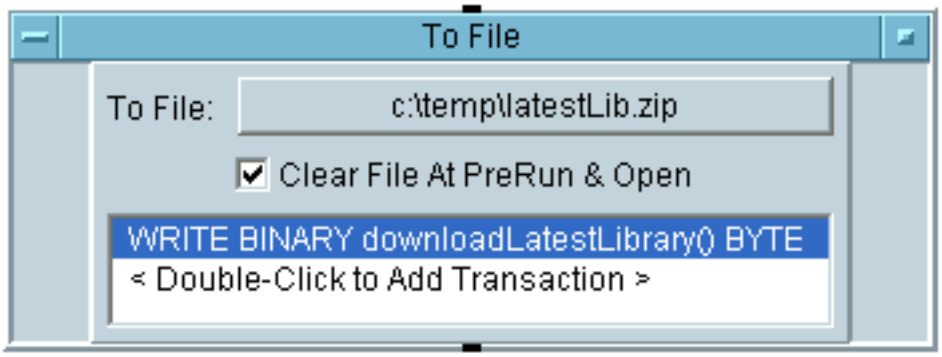
## Location

menu: veeos ==> System ==> downloadLatestLibrary

library: veeosLib

## Example

To download and save the latest version of the library:




## Notes

Since the (mandatory) veeosInit object already determines the latest version available, all that's left is to wander by the web and download the latest version. This uses a loop so will be slow but should also be quite robust.

## Reference

## Dependencies

network access

## Supported On

VEE 7.0+, all platforms

## See Also

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 11:30. 

```
(saveFormat "7.0")
(date "Mon 09/Nov/2015 12:37:03 ")
(veerev "7.0.6310.0")
(platform "PC")
(execMode v6)
(filterNAN 0)
(workspaceStackingOrder F1 F3 M)
(SaveCF no)
(device 0 ROOTCONTEXT
(properties
(trigMode deg)
(nextID 86)
(popupTitleText "Untitled")
(popupMoveable 1)
(deleteGlobals 0))
(deviceList
(UserFunctions
(nextID 6)
(context 1
(properties
(name "Drago_Random")
(trigMode deg)
(nextID 9)
(popupTitleText "UserFunction")
(popupMoveable 1))
(interface
(input 1
(name "low")
(optional yes))
(input 2
(name "high")
(optional yes))
(output 1
(type data)
(name "X")
(lock constraints)
(optional yes)))
(deviceList
(device 0 REPEATUNTILBREAK
(interface
(output 1
(name "Continuous")
(lock name constraints))))
(device 1 FORMULA
(properties
(name "random(low,high)")
(expr 1 "asInt32(random(low - 1, high + 1))"))
(interface
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(device 2 IFTHENELSE
(properties
(cases 1 "low<=A AND A<=high"))
(interface
(input 1
(name "A")
```

```
(optional yes))
(output 1
(name "Then")
(lock name constraints))
(output 2
(name "Else")
(lock name constraints))))
(device 3 NEXT)
(device 4 GATE
(interface
(input 1
(name "A")
(tag "InData"))
(output 1
(name "X"))))
(device 5 DECLVAR
(properties
(name "Declare low")
(scope con)
(globalName "low"))
(implementation
(value Int32
(data  0))))
(device 6 DECLVAR
(properties
(name "Declare high")
(scope con)
(globalName "high"))
(implementation
(value Int32
(data  0))))
(device 7 FORMULA
(properties
(expr 2 "low = A;" "high = B;"))
(interface
(input 1
(name "A")
(optional yes))
(input 2
(name "B")
(optional yes))
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(device 8 BREAK)
(configuration
(connect D7:0 D0:0)
(connect D0:1 D1:0)
(connect D1:1 D2:1)
(connect D2:2 D3:0)
(connect D2:1 D4:0)
(connect D1:1 D4:1)
(connect I1:1 D7:1)
(connect I2:1 D7:2)
(connect D4:0 D8:0)
(connect D4:1 O1:1)))
(contextCarrier
(wndOrigin 2 2)
(wndState res)
```

```
(active detail)
(detail
(extent 1234 870)
(anchorPt 181 358)
(configuration
(devCarrierFor 0
(active icon)
(icon
(extent 68 51)
(iconImage "loop.icn"))
(open)
(terminals on)
(pinCenter 130 90))
(devCarrierFor 1
(active open)
(icon
(extent 105 0))
(open
(extent 234 66))
(terminals on)
(pinCenter 180 220))
(devCarrierFor 2
(active open)
(icon)
(open
(extent 143 51))
(terminals on)
(pinCenter 485 220))
(devCarrierFor 3
(active icon)
(icon
(extent 28 15))
(open)
(terminals on)
(pinCenter 620 270))
(devCarrierFor 4
(active icon)
(icon
(extent 30 15))
(open)
(terminals on)
(pinCenter 670 300))
(devCarrierFor 5
(active open)
(icon
(extent 71 0))
(open
(extent 199 115))
(pinCenter 390 -20))
(devCarrierFor 6
(active open)
(icon
(extent 77 0))
(open
(extent 199 115))
(pinCenter 610 -20))
(devCarrierFor 7
(active open)
(icon)
(open
```

```
(extent 144 65))
(terminals on)
(pinCenter 120 10))
(devCarrierFor 8
(active icon)
(icon
(extent 36 15))
(open)
(terminals on)
(pinCenter 670 340))
(connect D7:0 D0:0
(points 2 130 45 130 62))
(connect D0:1 D1:0
(points 3 166 90 190 90 190 166))
(connect D1:1 D2:1
(points 2 349 220 381 220))
(connect D2:2 D3:0
(points 3 599 230 620 230 620 260))
(connect D2:1 D4:0
(points 3 599 210 670 210 670 290))
(connect D1:1 D4:1
(points 4 349 220 370 220 370 300 652 300))
(connect I1:1 D7:1
(points 4 -181 -144 -80 -144 -80 -10 15 -10))
(connect I2:1 D7:2
(points 4 -181 296 -70 296 -70 30 15 30))
(connect D4:0 D8:0
(points 2 670 310 670 330))
(connect D4:1 O1:1
(points 4 687 300 710 300 710 76 1052 76)))
(stackingOrder 0 2 4 5 6 7 3 1 8))))
(context 3
(properties
(name "Drago_Random1")
(trigMode deg)
(nextID 9)
(popupTitleText "UserFunction")
(popupMoveable 1))
(interface
(input 1
(name "low")
(optional yes))
(input 2
(name "high")
(optional yes))
(output 1
(type data)
(name "X")
(lock constraints)
(optional yes)))
(deviceList
(device 0 REPEATUNTILBREAK
(interface
(output 1
(name "Continuous")
(lock name constraints))))
(device 1 FORMULA
(properties
(name "random(low,high)")
(expr 1 "asInt32(random(low - 1, high + 1))"))
(interface
```

```
(input 1
(name "low")
(optional yes))
(input 2
(name "high")
(optional yes))
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(device 2 IFTHENELSE
(properties
(cases 1 "low<=A AND A<=high"))
(interface
(input 1
(name "low")
(optional yes))
(input 2
(name "high")
(optional yes))
(input 3
(name "A")
(optional yes))
(output 1
(name "Then")
(lock name constraints))
(output 2
(name "Else")
(lock name constraints))))
(device 4 GATE
(interface
(input 1
(name "A")
(tag "InData"))
(output 1
(name "X"))))
(device 8 BREAK)
(configuration
(connect D0:1 D1:0)
(connect I1:1 D1:1)
(connect I2:1 D1:2)
(connect I1:1 D2:1)
(connect I2:1 D2:2)
(connect D1:1 D2:3)
(connect D2:1 D3:0)
(connect D1:1 D3:1)
(connect D3:0 D4:0)
(connect D3:1 O1:1)))
(contextCarrier
(wndOrigin 2 2)
(wndState res)
(active detail)
(detail
(extent 1234 870)
(anchorPt 181 357)
(configuration
(devCarrierFor 0
(active icon)
(icon
```

```
(extent 68 51)
(iconImage "loop.icn"))
(open)
(terminals on)
(pinCenter 130 90))
(devCarrierFor 1
(active open)
(icon
(extent 105 0))
(open
(extent 234 66))
(terminals on)
(pinCenter 185 220))
(devCarrierFor 2
(active open)
(icon)
(open
(extent 143 62))
(terminals on)
(pinCenter 540 190))
(devCarrierFor 4
(active icon)
(icon
(extent 30 15))
(open)
(terminals on)
(pinCenter 670 300))
(devCarrierFor 8
(active icon)
(icon
(extent 36 15))
(open)
(terminals on)
(pinCenter 670 340))
(connect D0:1 D1:0
(points 3 166 90 190 90 190 166))
(connect I1:1 D1:1
(points 4 -181 -143 0 -143 0 200 25 200))
(connect I2:1 D1:2
(points 4 -181 297 -170 297 -170 240 25 240))
(connect I1:1 D2:1
(points 6 -181 -143 0 -143 0 40 370 40 370 170 426 170))
(connect I2:1 D2:2
(points 6 -181 297 -170 297 -170 280 380 280 380 190 426 190))
(connect D1:1 D2:3
(points 4 354 220 370 220 370 210 426 210))
(connect D2:1 D3:0
(points 5 654 170 680 170 680 250 670 250 670 290))
(connect D1:1 D3:1
(points 4 354 220 370 220 370 300 652 300))
(connect D3:0 D4:0
(points 2 670 310 670 330))
(connect D3:1 O1:1
(points 4 687 300 710 300 710 77 1052 77)))
(stackingOrder 0 3 4 1 2))))
(context 0
(properties
(name "o_randomInt")
(trigMode deg)
(nextID 6)
(popupTitleText "UserFunction1")
```

```
(popupMoveable 1))
(interface
(input 1
(name "min")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(input 2
(name "max")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(output 1
(type data)
(name "X")
(lock constraints)
(optional yes)))
(deviceList
(device 4 FORMULA
(properties
(name "")
(expr 1 "floor(random(min,max+1))"))
(interface
(input 1
(name "min")
(optional yes))
(input 2
(name "max")
(optional yes))
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(configuration
(connect I1:1 D0:1)
(connect I2:1 D0:2)
(connect D0:1 O1:1)))
(contextCarrier
(active detail)
(detail
(extent 1006 642)
(anchorPt 0 -4)
(configuration
(devCarrierFor 4
(active open)
(icon
(extent 5 25))
(open
(extent 344 56))
(terminals on)
(pinCenter 335 320))
(connect I1:1 D0:1
(points 4 0 164 10 164 10 300 120 300))
(connect I2:1 D0:2
(points 4 0 484 10 484 10 340 120 340))
(connect D0:1 O1:1
(points 4 559 320 782 320 782 324 1005 324))))))
```

```
(context 2
(properties
(name "o_randomInt2")
(trigMode deg)
(nextID 16)
(popupTitleText "UserFunction1")
(popupMoveable 1))
(interface
(input 1
(name "min")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(input 2
(name "max")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(output 1
(type data)
(name "X")
(lock constraints)
(optional yes)))
(deviceList
(device 4 FORMULA
(properties
(name "create the integers")
(expr 2 "ramp=ramp(max-min+1,min,max);" "randoms=randomize(ramp);"))
(interface
(input 1
(name "min")
(optional yes))
(input 2
(name "max")
(optional yes))
(output 1
(name "ramp")
(optional yes))
(output 2
(name "randoms")
(optional yes))
(output 3
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(device 14 TOCOMPLEX
(interface
(input 1
(name "Real64")
(requires
(datatype Real64))
(lock name constraints))
(input 2
(name "Imag")
(requires
(datatype Real64))
(lock name constraints))
(output 1
```

```
(name "Complex")
(lock name constraints))))
(device 15 FORMULA
(properties
(expr 1 "a=sort(a,1,1);re(a[0])"))
(interface
(input 1
(name "A")
(optional yes))
(output 1
(name "A")
(optional yes))
(output 2
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(configuration
(connect I1:1 D0:1)
(connect I2:1 D0:2)
(connect D0:1 D1:1)
(connect D0:2 D1:2)
(connect D1:1 D2:1)
(connect D2:2 O1:1)))
(contextCarrier
(active detail)
(detail
(extent 1006 642)
(anchorPt 131 23)
(configuration
(devCarrierFor 4
(active open)
(icon
(extent 112 25))
(open
(extent 284 80))
(terminals on)
(pinCenter 215 280))
(devCarrierFor 14
(active icon)
(icon
(extent 88 51)
(iconImage "build.icn"))
(open)
(terminals on)
(pinCenter 540 270))
(devCarrierFor 15
(active icon)
(icon
(extent 50 25))
(open
(extent 145 50))
(terminals on)
(pinCenter 690 280))
(connect I1:1 D0:1
(points 4 -131 137 -20 137 -20 260 30 260))
(connect I2:1 D0:2
(points 4 -131 457 -20 457 -20 300 30 300))
(connect D0:1 D1:1
(points 2 429 260 493 260))
```

```
(connect D0:2 D1:2
(points 2 429 280 493 280))
(connect D1:1 D2:1
(points 4 586 270 610 270 610 280 662 280))
(connect D2:2 O1:1
(points 4 717 290 740 290 740 297 874 297)))
(stackingOrder 0 1 2))))
(context 5
(properties
(name "o_randomInt_biased")
(trigMode deg)
(nextID 6)
(popupTitleText "UserFunction1")
(popupMoveable 1))
(interface
(input 1
(name "min")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(input 2
(name "max")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(output 1
(type data)
(name "X")
(lock constraints)
(optional yes)))
(deviceList
(device 4 FORMULA
(properties
(name "")
(expr 1 "intPart(random(min,max))"))
(interface
(input 1
(name "min")
(optional yes))
(input 2
(name "max")
(optional yes))
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(configuration
(connect I1:1 D0:1)
(connect I2:1 D0:2)
(connect D0:1 O1:1)))
(contextCarrier
(active detail)
(detail
(extent 1006 642)
(anchorPt 0 -4)
(configuration
(devCarrierFor 4
(active open)
```

```
(icon
(extent 5 25))
(open
(extent 344 56))
(terminals on)
(pinCenter 335 320))
(connect I1:1 D0:1
(points 4 0 164 10 164 10 300 120 300))
(connect I2:1 D0:2
(points 4 0 484 10 484 10 340 120 340))
(connect D0:1 O1:1
(points 4 559 320 782 320 782 324 1005 324))))))
(context 4
(properties
(name "o_randomInt_old")
(trigMode deg)
(nextID 6)
(popupTitleText "UserFunction1")
(popupMoveable 1))
(interface
(input 1
(name "min")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(input 2
(name "max")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(output 1
(type data)
(name "X")
(lock constraints)
(optional yes)))
(deviceList
(device 4 FORMULA
(properties
(name "engineering solution: not really correct but works well enough")
(expr 1 "floor(random(min,max+0.99999999999999))"))
(interface
(input 1
(name "min")
(optional yes))
(input 2
(name "max")
(optional yes))
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(configuration
(connect I1:1 D0:1)
(connect I2:1 D0:2)
(connect D0:1 O1:1)))
(contextCarrier
(active detail)
```

(detail
(extent 1006 642)
(anchorPt 0 -3)
(configuration
(devCarrierFor 4
(active open)
(icon
(extent 367 25))
(open
(extent 344 56))
(terminals on)
(pinCenter 335 320))
(connect I1:1 D0:1
(points 4 0 163 10 163 10 300 120 300))
(connect I2:1 D0:2
(points 4 0 483 10 483 10 340 120 340))
(connect D0:1 O1:1
(points 4 559 320 766 320 766 323 1005 323)))))))
(device 0 FORCOUNT
(properties
(count 100000))
(interface
(input 1
(name "Count")
(tag "Count")
(requires
(datatype Int32)
(shape "Scalar"))
(lock constraints)
(optional yes)
(buffer YES))
(output 1
(name "Count")
(lock name constraints))))
(device 1 CONSTANT
(properties
(name "reps"))
(interface
(output 1
(name "Int32")
(lock name constraints)))
(implementation
(value Int32
(data  100000))
(initValue Int32
(data  0))))
(device 3 START25
(properties
(name "speed test")))
(device 4 DO
(interface
(output 1
(name "Do"))))
(device 5 CONSTANT
(properties
(name "min"))
(interface
(output 1
(name "Int32")
(lock name constraints)))
(implementation

```
(value Int32
(data  -10))
(initValue Int32
(data  0))))
(device 6 CONSTANT
(properties
(name "max"))
(interface
(output 1
(name "Int32")
(lock name constraints)))
(implementation
(value Int32
(data  10))
(initValue Int32
(data  0))))
(device 7 TIMER
(interface
(input 1
(name "Time1")
(lock name constraints))
(input 2
(name "Time2")
(lock name constraints))
(output 1
(name "T2 - T1")
(tag "dTime")
(lock name constraints))))
(device 8 FORMULA
(properties
(expr 1 "A/B"))
(interface
(input 1
(name "A")
(optional yes))
(input 2
(name "B")
(optional yes))
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(device 9 TEXTDISPLAY
(properties
(name "time per"))
(interface
(input 1
(name "Data"))))
(device 10 FORCOUNT
(properties
(count 10))
(interface
(output 1
(name "Count")
(lock name constraints))))
(device 11 COLLECTOR
(properties
(output1D 0))
(interface
```

```
(input 1
(name "Data")
(tag "Data"))
(input 2
(type trigger)
(name "XEQ")
(lock name constraints))
(output 1
(name "Array")
(tag "Array"))))
(device 12 FORMULA
(properties
(expr 1 "mean(A)"))
(interface
(input 1
(name "A")
(optional yes))
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(device 15 FORCOUNT
(properties
(count 10))
(interface
(output 1
(name "Count")
(lock name constraints))))
(device 19 CONSTANT
(properties
(name "max"))
(interface
(output 1
(name "Int32")
(lock name constraints)))
(implementation
(value Int32
(data  100))
(initValue Int32
(data  0))))
(device 20 CONSTANT
(properties
(name "min"))
(interface
(output 1
(name "Int32")
(lock name constraints)))
(implementation
(value Int32
(data  -100))
(initValue Int32
(data  0))))
(device 21 DO
(interface
(output 1
(name "Do"))))
(device 22 START25
(properties
(name "check bias")))
(device 25 FORCOUNT
```

```
(properties
(count 201000))
(interface
(input 1
(name "Count")
(tag "Count")
(requires
(datatype Int32)
(shape "Scalar"))
(lock constraints)
(optional yes)
(buffer YES))
(output 1
(name "Count")
(lock name constraints))))
(device 26 COLLECTOR
(properties
(output1D 0))
(interface
(input 1
(name "Data")
(tag "Data"))
(input 2
(type trigger)
(name "XEQ")
(lock name constraints))
(output 1
(name "Array")
(tag "Array"))))
(device 30 REGRESSION
(properties
(fit LIN)
(order 2))
(interface
(input 1
(name "Point List")
(tag "InCoords")
(requires
(datatype Coord))
(lock name constraints))
(output 1
(name "Fitted Data")
(tag "OutCoords")
(lock name constraints))
(output 2
(name "Coeffs")
(tag "Coeffs")
(lock name constraints))
(output 3
(name "Goodness")
(tag "Goodness")
(lock name constraints))))
(device 31 TEXTDISPLAY
(interface
(input 1
(name "Data"))))
(device 32 TEXTDISPLAY
(interface
(input 1
(name "Data"))))
```

```
(device 33 CONTEXT
(properties
(name "how many of each?")
(trigMode deg)
(nextID 11)
(popupTitleText "UserObject")
(popupMoveable 1))
(interface
(input 1
(name "min")
(optional yes))
(input 2
(name "max")
(optional yes))
(input 3
(name "A")
(optional yes))
(output 1
(type data)
(name "X")
(lock constraints)
(optional yes)))
(deviceList
(device 9 FORMULA
(properties
(name "magDist(x,from,thru,step)")
(expr 1 "magDist(x,from,thru+1,step)"))
(interface
(input 1
(name "x")
(optional yes))
(input 2
(name "from")
(optional yes))
(input 3
(name "thru")
(optional yes))
(input 4
(name "step")
(optional yes))
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
(optional yes))))
(device 10 CONSTANT
(properties
(name "Int32"))
(interface
(output 1
(name "Int32")
(lock name constraints)))
(implementation
(value Int32
(data  1))
(initValue Int32
(data  0))))
(configuration
(connect I3:1 D0:1)
(connect I1:1 D0:2)
(connect I2:1 D0:3)
```

```
(connect D1:1 D0:4)
(connect D0:1 O1:1)))
(contextCarrier
(active detail)
(detail
(extent 727 370)
(anchorPt 8 3)
(configuration
(devCarrierFor 9
(active open)
(icon
(extent 152 0))
(open
(extent 189 90))
(terminals on)
(pinCenter 245 130))
(devCarrierFor 10
(active open)
(icon)
(open
(extent 67 29)
(showFormat int))
(pinCenter 70 240))
(connect I3:1 D0:1
(points 4 -8 301 0 301 0 100 108 100))
(connect I1:1 D0:2
(points 4 -8 61 10 61 10 120 108 120))
(connect I2:1 D0:3
(points 4 -8 181 10 181 10 140 108 140))
(connect D1:1 D0:4
(points 6 106 240 130 240 130 200 90 200 90 160 108 160))
(connect D0:1 O1:1
(points 4 392 130 410 130 410 181 718 181)))
(stackingOrder 0 1))))
(device 34 YPLOT
(properties
(name "XY Trace"))
(interface
(input 1
(name "Trace1")
(lock constraints)))
(implementation
(tracePin 1)
(graphMode rectangular)
(autoAutoX)
(autoAutoY)))
(device 35 FORMULA
(properties
(expr 1 "(max-min+1)*1000"))
(interface
(input 1
(name "min")
(optional yes))
(input 2
(name "max")
(optional yes))
(output 1
(name "Result")
(tag "Result")
(lock name constraints)
```

(optional yes))))
(device 38 NOTE
(properties
(name "data from same machine/same time period")
(text2 1
"{\\rtf1\\ansi\\ansicpg1252\\deff0\\deflang1033{\\fonttbl{\\f0\\fnil\\fcharset0 Times New Roman;}}\r\n{\\colortbl ;\\red0\\green0\\blue0;}\r\n\
\viewkind4\\uc1\\pard\\cf1\\f0\\fs24 data includes time per, best fit line slope and residual error from linear fit\\par\r\n\\par\r\n21 elements\\par\r
\ndrago_random1 - \\i 16.88u\\i0 , -1.536, 12m\\par\r\ndrago_random - \\i 24.08u\\i0 , 4.792, 78m\\par\r\no_randomInt2 - \\b 23.36u\
\b0 , .7597, 2m\\par\r\no_randomInt - 7.48u, 3.839, 72m\\par\r\n\\par\r\n203 elements\\par\r\no_randomInt() - 7.072u, 38m, 0.5m
\\par\r\ndrago_random() - 24.16u, 42m, .6558m\\par\r\ndrago_random() - 24.15u, -76m, 1.85m\\par\r\no_randomInt2() - \\b 47.35u\\b0 ,
0.1182, 4.969m\\par\r\no_randomInt2() - \\b 48.4u\\b0 , -89.29m, 2.463m\\par\r\ndrago_random1() - 16.78u, 15m, 78u\\par\r
\ndrago_random1() - 16.83u, -39m, 0.5m\\par\r\n\\par\r\n2001 elements\\par\r\ndrago_random1 - 16.38u, 4.24m, 60.28u\\par\r
\ndrago_random - 23.61u, -6.47m, 145m\\par\r\no_randomInt2 - \\b 358u\\b0 , -7.32m, 1.685m\\par\r\no_randomInt - 7.47u, 2m, 15u\
\par\r\n\\par\r\n}\r\n"
)))
(device 76 CALL
(properties
(name "Call o_randomInt")
(callFunc "o_randomInt")
(parmMode rev30))
(interface
(input 1
(name "min")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(input 2
(name "max")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(output 1
(name "X")
(lock name constraints)
(optional yes))))
(device 77 NOTE
(properties
(text2 1
"{\\rtf1\\ansi\\ansicpg1252\\deff0\\deflang1033{\\fonttbl{\\f0\\fnil\\fcharset0 Times New Roman;}}\r\n{\\colortbl ;\\red0\\green0\\blue0;}\r\n\
\viewkind4\\uc1\\pard\\cf1\\f0\\fs24 Here several routines are compared with a crude but hopefully representative test. Not surprisingly the fastest method is also the simplest. More interestingly, note the performance difference between drao_random and drago_random1, whose only real difference is in using a local variable as opposed to a scoped variable. Apparently there\'s a significant time cost for scoped variables. Also somewhat surprisingly, note that all routines scale well with the range of integers chosen- except for o_randomInt2, which gets oppresively long with large range. If you run this several times you\'ll see a fair amount of variance in the slope and residual error, but consider that there\'s only 10k samples of easy and these variations are actually quite small. o_randomint_engr is an \"engineering\" solution that was done before realizing that random() uses range [a,b) so that there\'s no need to fudge the upper end.\\par\r\n\\par\r\nAn example of a biased solution is given in the seemingly reasonable o_randomint_biased which uses\\i intPart(random(min,max))\\i0 . While this seems obvious enough- generate random real over the range and convert to int, it also has significant problems. Try splicing in this one to the below test and look at resulting plot.\\i\\par\r\n}\r
\n"
)))
(device 78 LABEL
(properties
(name "enough runs to expect 10k of each possible integer")
(labelValue "enough runs to expect 10k of each possible integer"))
(implementation))
(device 79 LABEL
(properties
(name "a straight 1M runs")
(labelValue "a straight 1M runs"))

```
(implementation))
(device 85 CALL
(properties
(name "Call o_randomInt")
(callFunc "o_randomInt")
(parmMode rev30))
(interface
(input 1
(name "min")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(input 2
(name "max")
(requires
(datatype Int32)
(shape "Scalar"))
(optional yes))
(output 1
(name "X")
(lock name constraints)
(optional yes))))
(configuration
(connect D3:0 D0:0)
(connect D1:1 D0:1)
(connect D9:1 D3:0)
(connect D3:1 D6:1)
(connect D0:0 D6:2)
(connect D6:1 D7:1)
(connect D1:1 D7:2)
(connect D11:1 D8:1)
(connect D2:0 D9:0)
(connect D7:1 D10:1)
(connect D9:0 D10:2)
(connect D10:1 D11:1)
(connect D16:0 D12:0)
(connect D12:1 D15:0)
(connect D15:0 D17:0)
(connect D24:1 D17:1)
(connect D30:1 D18:1)
(connect D12:0 D18:2)
(connect D22:1 D19:1)
(connect D19:3 D20:1)
(connect D19:2 D21:1)
(connect D14:1 D22:1)
(connect D13:1 D22:2)
(connect D18:1 D22:3)
(connect D22:1 D23:1)
(connect D14:1 D24:1)
(connect D13:1 D24:2)
(connect D0:1 D26:0)
(connect D4:1 D26:1)
(connect D5:1 D26:2)
(connect D17:1 D30:0)
(connect D14:1 D30:1)
(connect D13:1 D30:2)))
(contextCarrier
(wndOrigin 2 2)
(wndState res)
```

```
(active detail)
(detail
(extent 1270 898)
(anchorPt -49 32)
(configuration
(devCarrierFor 0
(active icon)
(icon
(extent 68 51)
(iconImage "loop.icn"))
(open
(extent 95 31))
(pinCenter 290 290))
(devCarrierFor 1
(active open)
(icon
(extent 29 0))
(open
(extent 67 29)
(showFormat int))
(pinCenter 150 310))
(devCarrierFor 3
(active open)
(icon
(extent 63 0))
(open
(extent 114 24))
(title off)
(pinCenter 190 130))
(devCarrierFor 4
(active icon)
(icon
(extent 24 15))
(open)
(terminals on)
(pinCenter 290 230))
(devCarrierFor 5
(active open)
(icon
(extent 25 15))
(open
(extent 67 29)
(showFormat int))
(pinCenter 420 290))
(devCarrierFor 6
(active open)
(icon
(extent 27 15))
(open
(extent 67 29)
(showFormat int))
(pinCenter 420 350))
(devCarrierFor 7
(active icon)
(icon
(extent 68 51)
(iconImage "timer.icn"))
(open
(extent 72 31))
(pinCenter 370 410))
(devCarrierFor 8
```

```
(active icon)
(icon
(extent 50 25))
(open
(extent 145 50))
(terminals on)
(pinCenter 480 420))
(devCarrierFor 9
(active open)
(icon
(extent 49 0))
(open
(extent 121 22))
(pinCenter 760 430))
(devCarrierFor 10
(active icon)
(icon
(extent 68 51)
(iconImage "loop.icn"))
(open
(extent 95 31))
(pinCenter 190 200))
(devCarrierFor 11
(active icon)
(icon
(extent 53 25))
(open)
(terminals on)
(pinCenter 570 430))
(devCarrierFor 12
(active icon)
(icon
(extent 50 15))
(open
(extent 145 50))
(terminals on)
(pinCenter 650 430))
(devCarrierFor 15
(active icon)
(icon
(extent 68 51)
(iconImage "loop.icn"))
(open
(extent 95 31))
(pinCenter 210 580))
(devCarrierFor 19
(active open)
(icon
(extent 27 15))
(open
(extent 67 29)
(showFormat int))
(pinCenter 110 720))
(devCarrierFor 20
(active open)
(icon
(extent 25 15))
(open
(extent 67 29)
(showFormat int))
```

```
(pinCenter 110 630))
(devCarrierFor 21
(active icon)
(icon
(extent 24 15))
(open)
(terminals on)
(pinCenter 310 610))
(devCarrierFor 22
(active open)
(icon
(extent 64 0))
(open
(extent 114 24))
(title off)
(pinCenter 210 510))
(devCarrierFor 25
(active open)
(icon
(iconImage "loop.icn"))
(open
(extent 95 31))
(pinCenter 310 690))
(devCarrierFor 26
(active icon)
(icon
(extent 53 25))
(open)
(terminals on)
(pinCenter 630 700))
(devCarrierFor 30
(active icon)
(icon
(extent 71 34))
(open
(extent 116 70))
(terminals on)
(pinCenter 430 830))
(devCarrierFor 31
(active open)
(icon)
(open
(extent 121 22))
(pinCenter 760 880))
(devCarrierFor 32
(active open)
(icon)
(open
(extent 134 66))
(pinCenter 600 820))
(devCarrierFor 33
(active icon)
(icon
(extent 116 34))
(terminals on)
(pinCenter 750 700))
(devCarrierFor 34
(active open)
(icon
(iconImage "display.icn"))
(open
```

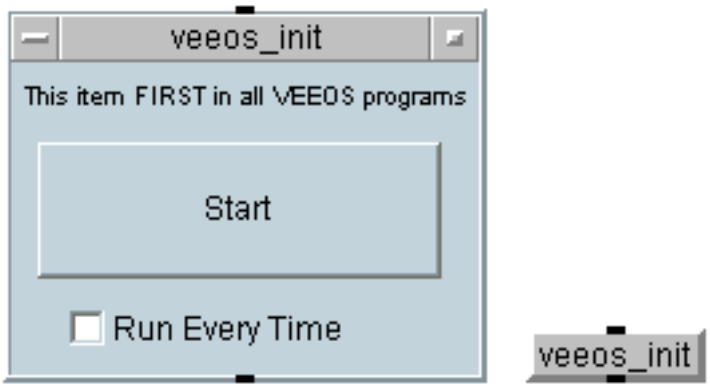
```
(extent 1071 185)
(displayMode 47)
(graphType cartesian)
(gridType grid)
(scale 0
(name "Y name")
(domainName "X name")
(Yspacing 1)
(Xspacing 2)
(pen 9)
(show 1)
(range 0 25000 4 linear))
(domain 0 200 4 linear)
(trace 0 onScale 0
(name "Trace1")
(traceColor "Yellow")
(lineType 12)
(pointType 0))
(markerColor "Dark Gray"))
(pinCenter 650 1010))
(devCarrierFor 35
(active icon)
(icon
(extent 50 25))
(open
(extent 145 50))
(terminals on)
(pinCenter 200 670))
(devCarrierFor 38
(active open)
(icon
(extent 261 0)
(iconImage "notepad.icn"))
(open
(extent 404 606)
(editing enabled))
(pinCenter 1060 570))
(devCarrierFor 76
(active icon)
(icon
(extent 104 25))
(open
(extent 176 51))
(terminals on)
(pinCenter 660 320))
(devCarrierFor 77
(active open)
(icon
(iconImage "notepad.icn"))
(open
(extent 974 206)
(editing enabled))
(pinCenter 800 110))
(devCarrierFor 78
(active open)
(icon
(extent 306 0))
(open
(extent 291 27)
(just l))
```

```
(title off)
(pinCenter 500 540))
(devCarrierFor 79
(active open)
(icon
(extent 107 0))
(open
(extent 110 27)
(just l))
(title off)
(pinCenter 560 280))
(devCarrierFor 85
(active icon)
(icon
(extent 104 25))
(open
(extent 176 51))
(terminals on)
(pinCenter 480 690))
(connect D3:0 D0:0
(points 2 290 240 290 262))
(connect D1:1 D0:1
(points 4 186 310 220 310 220 290 253 290))
(connect D9:1 D3:0
(points 3 226 200 290 200 290 220))
(connect D3:1 D6:1
(points 6 304 230 360 230 360 340 310 340 310 400 333 400))
(connect D0:0 D6:2
(points 3 290 318 290 420 333 420))
(connect D6:1 D7:1
(points 2 406 410 452 410))
(connect D1:1 D7:2
(points 6 186 310 200 310 200 470 430 470 430 430 452 430))
(connect D11:1 D8:1
(points 2 677 430 697 430))
(connect D2:0 D9:0
(points 2 190 144 190 172))
(connect D7:1 D10:1
(points 2 507 420 541 420))
(connect D9:0 D10:2
(points 7 190 228 190 250 210 250 210 460 520 460 520 440 541 440))
(connect D10:1 D11:1
(points 2 599 430 622 430))
(connect D16:0 D12:0
(points 2 210 524 210 552))
(connect D12:1 D15:0
(points 3 246 580 310 580 310 600))
(connect D15:0 D17:0
(points 2 310 620 310 654))
(connect D24:1 D17:1
(points 4 227 670 250 670 250 690 260 690))
(connect D30:1 D18:1
(points 2 534 690 601 690))
(connect D12:0 D18:2
(points 7 210 608 210 620 270 620 270 570 550 570 550 710 601 710))
(connect D22:1 D19:1
(points 6 810 700 830 700 830 750 370 750 370 830 392 830))
(connect D19:3 D20:1
(points 4 468 840 490 840 490 880 697 880))
(connect D19:2 D21:1
(points 4 468 830 490 830 490 820 530 820))
```

```
(connect D14:1 D22:1
(points 6 146 630 400 630 400 660 670 660 670 690 689 690))
(connect D13:1 D22:2
(points 8 146 720 170 720 170 730 380 730 380 740 680 740 680 700 689 700))
(connect D18:1 D22:3
(points 4 659 700 670 700 670 710 689 710))
(connect D22:1 D23:1
(points 8 810 700 830 700 830 750 370 750 370 830 90 830 90 1010 112 1010))
(connect D14:1 D24:1
(points 4 146 630 160 630 160 660 172 660))
(connect D13:1 D24:2
(points 4 146 720 160 720 160 680 172 680))
(connect D0:1 D26:0
(points 5 326 290 350 290 350 240 660 240 660 305))
(connect D4:1 D26:1
(points 4 456 290 480 290 480 310 605 310))
(connect D5:1 D26:2
(points 4 456 350 480 350 480 330 605 330))
(connect D17:1 D30:0
(points 5 360 690 380 690 380 670 480 670 480 675))
(connect D14:1 D30:1
(points 4 146 630 400 630 400 680 425 680))
(connect D13:1 D30:2
(points 6 146 720 170 720 170 730 380 730 380 700 425 700)))
(stackingOrder 1 3 2 15 16 17 6 7 13 5 14 24 12 0 4 10 11 8 26 18 19 21 20 23 25
28 9 29 22 27 30))
(numberFormats
(realFormat standard)
(realSigDigits 4)
(realRadixSpec 4)
(integerBase decimal))))
```

# veeosInit

*Initializes the loading of veeos*




## Syntax

- veeosInit has no underlying function

## Usage

Place this object at the beginning of any program that uses the veeos library. Set "Run Every Time" to cause this object to execute each time your program is run.

## Location

menu: veeos ==> Veeos Init

## Notes

Since the veeosInit object is to be included in all VEE programs that use the veeos library, it is designed to be as small as possible and to have the absolute minimum hard-coded functionality. In essence it does nothing other than to find and import a library called bootstrapLib and then run a function from that library called init. It also only runs the very first time a program is run and then takes no action later, hence minimizing overhead.

In searching for bootstrapLib itself, veeosInit searches the below locations in series and stopping as soon as the first is found. This order is chosen for standard precedence: the most specific definition takes precedence.

1. Environment variable - if it exists, the variable MY_BOOTSTRAPLIB is used to identify the library file to load.
2. Local directory - searched for bootstrapLib.vxe
3. Home directory - searched for bootstrapLib.vxe
4. VEE Install directory- searched for bootstrapLib.vxe

Hence  Hence the default behavior is to use the bootstrapLib that comes with veeos, but any other alternative takes precedence.

NOTE that due to this behavior, veeosInit can initiate any functionality that the end user desires. All one needs to do is to create their own library and point to it. the only requirement is that there is a function called init() in this library. The end result is that although veeosInit is part of veeos it

can alternately be used for initiating the end user's customizations instead (or in addition).

By default, veeosInit runs the very first time that a program containing it executes. On subsequent runs veeosInit skips its internal functionality in order to minimize the time it takes to run. To override this behavior, the Run Every Time option can be selected. This causes veeosInit to execute all of its functionality at every program run. This can be useful when doing development work since it causes a fresh start of veeos configuration. Run Every Time is best left unchecked after development is done.

## Reference

## Dependencies

bootstrapLib

## Supported On

VEE 7.0+, all platforms

## See Also

bootstrapLib

 Stan Bischof (stan@worldbadminton.com). Last updated 04 November 2015 10:51. 