VERITOOL'S TUTORIAL FOR USING VWAVE AS A MIXED MODE DISPLAY

MIXED MODE WITH VWAVE

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This tutorial demonstrates the use of the Veritools vWave software in a mixed mode, both analog, digital and mixed analog/digital debugging environment. To start the vWave Mixed mode tutorial got to the file, analog, in the directory examples in your software distributions directory



In this directory select the file anja.dump.fast to bring in by pressing the following menu items:

File -> Open File -> anaj.dump.fast

Your vWave window will look as shown in the next figure after you select the anja.dump.fast file.

vWave /home/de	emo/distributions/ut2k10.1.8/	examples/analog/anja.du	mp.fast - Version 2010.1	1.8 Wed Jun 22 04:31:0	6 2016 _ 🗆 ×
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The vWave window has menus items listed across the top of the display window, icon buttons are displayed just below these menu items, an area for listing the displayed signal names on the left side of this window just below the icon buttons. To the immediate right of the signal displayed signal list is the area that displays the value of the TO/YO cursor, and to the right of this the waveform display area. At the bottom of the vWave window is the area for the design hierarchy, with module names listed on the left and the signal names on the right.

Next select the module name s85. This will list all of the signals that are in this s85 module as shown below:

Also note the pointer is pointing at the name of the file



currently that is active in the design hierarchy window. When more than one waveform file is loaded to the vWave, the user can select which file is to be made active in the design hierarchy window.

Using the left mouse button, users can select signal names in the signal name area to be displayed in the waveform area. The selected names are highlighted with a white background.

vWave /home/demo/dis	stributions/ut2k10.1.8/exa	amples/analog/anja.dum	p.fast - Version 2010.1.8	Wed Jun 22	04:31:06 2016	_ 0 ×
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Also note in this display, the location for hierarchy icon for the "Display" icon is shown. Pressing this icon down will display all of the signals that are currently highlighted, turn off the highlight and add a "*" to each signal name in the signal selection area that has just been display so users will know if any signal in this area is already on the waveform display. When the selected signals are displayed, the signal names are listed in the signal names list of the left of the display window, along with a number at the front of the name, 1,2, 3, etc., and the file names indicating the file each signal came from, as shown below:

Also note the values in the Y0/T0 area are initially at time zero, until the users sets a new value in the Y0/T0

cursor.

vWave /home/demo/d	listributions/	ut2k10.1.8/ex	amples/analo	og/anja.dum	np.fast - Ver	sion 2010.1.	8 Wed Jun 2	22 04:31:06	2016
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i85 pclock clockwave p1 r0	cwave t1	*a[7:0] *ale *aRealOne *clock *ad[7:0]	*dflags[8:1] *intr *hold *ionout	*nreset *read *pclock *ready	rst5p5 rst7p5 rst6p5 rxd	s0 txd trap write

Next to now bring in analog file, do the following to select this file:

File -> Open Additional File. This will bring in a new file selection window as shown below:

Open Dump File _ □ ×									
Filter									
<pre>rome/demo/distributions/ut2k10.1.8/examples/analog/*</pre>									
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Add To Open Files	Start Interactive Tool								
Create & I	Load Fast File								
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ons/ut2k10.1.8/examples/	<pre>ons/ut2k10.1.8/examples/analog/si.tr0.wsf.ascii.fast[</pre>								
Open Filter	Cancel Help								

Now in this window select the analog file as highlighted. Note that fast files can be made when selected files are brought in, using the icon shown above, "Create and Load Fast File", or using vdump a batch tool that will quickly make fast file in a batch process. A typical vdump command would be: %vdump -Cxn vcd.file, which will become vcd.file.fast

vWave /home/demo/di	stributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 2
File Format Options Window Tools Help	
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Modules: Filter	Variables: Filter
•• network	

This cursor now points to the active file name text area that holds name of the file that is now the active file for the current hierarchy window.

Users can select any file in the Active Signal Name text area to now make that the file active in the vWave window.

Now select "network' to display the signal names for the analog design in hierarchy "network".



This will list the signal names for the analog module "network" as shown below:

vWave /home/demo/dis	tributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016 💷 🗉 🗄
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/1_anja_dump_fast/s85/ale >	
/1_anja_dump_tast/s85/clock L	
/1_anja_dump_tast/s85/bold 0	0 100. 200. 200. 100. 100. 100. 100. 100
咒器 № 1/2_si_tr0_wsf_a	iscii_fast/network (si.tr0.wsf.ascii.fast)
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Next sliding the left mouse over the signal names you want to display.

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Then press display, as shown by the pointer, to add these signal waveforms to the already present digital waveform display:



Note that when adding analog into a digital waveform display the horizontal scale for the analog file must be "Time" and note that even if the horizontal scale is time the analog can have a different time period for the simulation than the digital as show above.



To show the complete analog simulation synchronized in time, zoom the analog waveforms by pressing the right mouse button down on the waveform display window above and to the left of where you want to zoom, and slide the cursor down and to the right over the signals you want to zoom into. The result display will then look as shown below:



In addition to adding the analog right onto the waveform display with the digital, you can also add a new pane, and have the analog added to just that pane. To add a new time pane, do the following:

Window -> Panes -> Add New Pane, Time

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The result is shown below:



Next select the Choose icon to add a signal selector to this waveform window:



This will bring in a signal selector for the new analog file as shown below:

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/1_anja_dump_fast/s85/nreset	0						
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r0_wsf_ascii_fast/network/l(vclk2)(i)	0A 0H					V	
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Then select the analog signal you want on this pane:

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		*I(vddsup)(i) *clk2(v)	*i10y(v)	*i25y(v)	*109 *i7y	(v) i	load(v)	xi10.i2s(v)	ALG. MIU(V)	ALG:LL3(V)

Make sure the new pane is the active pane, if the "T" (which stands for time), in the upper left hand corner of each pane for the new pane does not have a Yellow back ground select it to make this pane active.



Then press Display as shown below to display the selected signals in the new time pane.

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T8Last: VO			150n	200)n [2	250n	300n	350n	4	00n
/1_anja_dump_tast/s85/intr	0									
/1 ania dump_fast/s85/iomout	v									
/1_ania_dumn_fast/s85/nreset	Ô									
/1_ania_dump_fast/s85/nclock	0									
/1 ania dump_tast/s85/read	v									
/1 ania dumn fast/s85/ready	n									
In_unju_uump_ruotocomouuty	100uf	— h		·),		k		· 1		h ·
r0_wsf_ascii_fast/network/l(vclk2)(i)	OA OA	┢──╱└──		/		/		/		/_
	-100uf	┢	- Y -		V ·		. 1	4		•
	-5000				W		γ	W/		
_wsf_ascii_fast/network/l(vddsup)(i) -193.00	OpA 150	0	100u	200u	300u	400u	500u	600u	700u	800u
	12-2-04									
T1Last: Y0	0	1	.0u 2	20u	30u	40u	50u	60u	70u	80u
	0		100u	200u	300u	400u	500u	600u	700u	800u
A NA								· · ·		
The selay of the selar s	f_ascii_fa	st/network	(si.tr0.wsf. a sci	i.fast)						
Modules: Filter	Yari	ables: Fi	lter							
••	0(v)	>	*I(vload)(i)	*clkn(v)	*i11y(v)	*i3y(v)) i	.9y(v) r	eset(v)	xi3.n0d(v)
	*I(v	:lk2)(i) ddsup)(i)	<pre>*I(vreset)(i *clk2(v)</pre>) *clks(v) *i10y(v)	*i1y(v) *i25y(v)	*i6y(v) *i7y(v)		ld(v) v load(v) x	dd(v) (i10.i2s(v)	xi3.n1d(v)

The resultant waveform display will look as shown below after display is pressed:



These panes can be synced together in two different ways, by syncing on the start and end points of the horizontal scroll bars, which keeps the zooms the same or by syncing on the middle of the horizontal scroll bar which allows the zoom setting to be different between these panes.

nterions Places	System 🔞 🔗 🗾					
vW	ave /home/demo/distribu/	tions/u	t2k10.1.8/example	es/analog	/ania.dump.f/	ast - Version 2
Eile Fermat Ontione	Hinday Toolo Holo	crons, a	circioni in a contractione de la contractica de	cs/analog,	anjaraampin	
			E ou cture ct	- 		
🎦 🔥 🖽 🖱 ∿ ń	Configuration	6	h west west west west	<u>*** = 0 0</u>	<u> </u>	2 👬 👯 🔙
⊤8Last:	Navigator	× .	150n	200n	250n	1 300 1
/1 ania dump_fas	Cursors					
/1 ania dumn fast/s	Lock Cursor, Selected Sign	ial 🖉				
/1 ania dumn fast/s	Honotate Maverorms					
/1_ania_dump_fast/s	Tags Fit To Pape					
/1 ania dump fast	Horizontal Sceolling					
/1 ania dump fast/s	Vertical Scrolling					
	Set Display Interval	l l		· A		k ·
r0_wsf_ascii_fast/network/	X Axis - Log Scale		·	/		/
	🗉 Auto Update		· V		V ·	
	✓ Show Complete Signal Name		·		W	
_wsf_ascii_fast/network/I(\	Real Time	>	100u	200u	300u	400u E
	Time Scale	=				
<mark>⊤</mark> 1Last:	Waveforn Heights		50n	100n	150n	200n
	Panes	P = -				
?_si_tr0_wsf_ascii_fast/net	Yalue Areas	> He	dd New Pane, lime			
	Floating Windows	, He	dd New Pane, Hrbitra	ary X		· .
r0 wef accii fact/actwork/l					•	
	-100u		ine ranes	S	ync Panks, Sta	rt-End
	5008	0	50n	100n S	ync Panes, Mid	dle ^{On}
咒 🌬 ∿ 🐨 🗠 🌾	🥀 /2_si_tr0_wsf_ascii_fa	st/netwo	ork (si.tr0.wsf. ascii.fa st	.)		
Modules: Filter	Yari	ables:	Filter I			
	*0(v *1(v *1(v) clk2)(i ddsup)(*I(vload)(i) **) *I(vreset)(i) ** i) *clk2(v) **	clkn(v) clks(v) i10y(v)	*i11y(v) *i1y(v) *i25y(v)	*i3y(v) *i6y(v) *i7y(v)

The above figure shows the display windows synced with start end points the same. Note that the top time scales between these Panes are identical, as can be seen in the following figure:



Next add a *ac0 file to the waveform display by selecting this file from the list of files in the analog directory as shown below:

Open Dur	mp File _ 🗆 🗙						
Filter							
Directories *xanples/analog/ *xanples/analog/ *xanples/analog/nacro	Files anja.dunp.fast csdf.ac0 csdf.dc0 csdf.tr0 csdf.tr0.fast dunp.vcd						
Add To Open Files	Start Interactive Tool						
Create & L	oad Fast File						
Selection ho/distributions/ut2k10.	1.8/examples/analog/csdf.ac0						
Open Filter	Cancel Help						

Next select the csdf.ac0 file and press "Add to open Files".



Select signals again, by pressing down the right mouse button and dragging this over the signal names you want to see on the display:



Note that when a file that does not have a time base for its horizontal scale is brought into the waveform display that currently has only time based files, a new non-time pane, an Arbitrary X Scale Pane is automatically added to display these new signals as shown below:

vWave /ho	ome/demo/di	istributions/u	t2k10.1.8/exa	mples/analog,	/anja.dump	o.fast - Versi	on 2010.1.8	Wed Jun 22	04:31:06 20	016	_ 🗆 ×
File Format Options Window	Tools Help										
🎥 🔥 🖻 😁 🖑 📽 🖻	ဂ က 🎼		k vék vék vék	\$\$ \$\$ 🙀 🖗	λ 🗠 🔨	👌 ?📩 🗿	🐺 👯 📷 .	🏷 🎇 🖑			
T BLast:	YO	310n	320n	330n	340n	350n	360n	370n	380n	390n	400n
/1 ania dump_fast/s85/intr	r										
/1 ania dump fast/s85/iomou	t	x									
/1_anja_dump_fast/s85/nreset	t	0									
/1_anja_dump_fast/s85/pclock	<	0									
/1_anja_dump_fast/s85/read	k	x 0	100u	200u	300u	400u	500u	600u	700u	800u	900u
											<u> </u>
Ţ 1 Last: ∭	YO	310n	320n	330n	340n	350n	360n	370n	380n	390n	400n
) ai trū uot papii fastinatuark(0/u)		500nV									. 4
) (-500mV 0	50n	100n	150n	200n	250n	300n	350n	400n	450n
		> 100uR <									
Allast:	YO	0	100n	200n	300n	400n	500n	600n	700n	800n	900n
(2. andf. anD/EREOLIENC)		500n									A
73_CSUI_ACOPPEQUENCY		-500n									
		500m8 0	100n	200n	300n	400 n	500 n	600 n	700n	800n	900n
											P
[[] 2월 🔊 🐨 🔟 🖓 🦂	/3_csdf_ac0 (c	csdf.ac0)									
Modules: Filter		Yariables:	Filter								
•• xq2 xq2b xq5b xq6b x	rbg xrnet	*FREQUENCY		¥(4:nd5)(real)	(v)	V(a5a)(real)	(v)	V(bias)(real)(v)	¥(n1n97)(re	al)(v)
xq12 xq2a xq5 xq6 xq9		*I(v_x1i179 *I(v_x1i179)(imag)(i))(magn)(i)	V(4:tw)(imag)(V(4:tw)(magn)((v) (v)	V(a5b)(imag) V(a5b)(magn)	(v) (v)	Y(g)(imag)(v V(g)(magn)(v	•) •)	¥(tap)(imag V(tap)(magn)(v))(v)
		*I(v_x1i179 *I(v_x1i179)(phas)(deg))(real)(i)	V(4:tw)(phas)(V(4:tw)(real)(deg) v)	V(a5b)(phas) V(a5b)(real)	(deg) (v)	Y(g)(phas)(d Y(g)(real)(v	leg)	V(tap)(phas V(tap)(real)(deg)
		*I(v_x1i201)(imag)(i)	V(a1)(imag)(v)		V(a6)(imag)(v)	¥(n1n131)(im	ag)(v)	V(v)(imag)(v)
		I(v_x11201)(phas)(deg)	V(a1)(phas)(de	g)	V(a6)(phas)(deg)	V(n1n131)(ma	as)(deg)	V(v)(phas)(deg)
L			l(real)(i)	V(al)(real)(u)		Vis6)(res1)(Vin1n131\ire	al)(n)	//ادمع//س/۳	m 14

Pressing full zoom, will display the full simulation waveforms for these newly selected signals.

vWave /ho	me/demo/dist	ributions/	ut2k10.1.8/exam	ples/analog	/anja.dum	p.fast - Versio	on 2010.1.8	Wed Jun 2	2 04:31:06 20	16	_ 0 ×
File Format Options Window	Tools Help	X0=10.2654									
🔐 🔥 🗈 😁 🛷 👯 🖉	ን 🗠 🚺 🕫 📑		<u>ૡૻ</u> ૡૣ ૡ <u>ૡ</u> ૡ	* 🕵 🔟 0	2 🗠 🔨		🗧 🔅 📼 🧏	2 😹 🔍			
T8Last: []	YO	310n	320n	330n	340n	350n	360n	370n	380n	390n	400n
/1_ppip_dump_rasvsosmora											
/1_anja_dump_tast/s85/intr	U										
/1_anja_dump_tast/s85/tombut	X										_
/1_anja_dump_tast/s65/meset	0										
/1_anja_dump_tast/s85/pclock	U										
(1 ania dump_fast/sourcedu	~ ^										
/i_anja_dump_iasvsooready	U	100.08-					· Δ.				
rD wsf. ascii fast/network/l(vclk2)(i)	ΠA	08					^				
		-100ufi 0	100u	200u	300u	400u	500u	600u	700u	800u	900u
		na ≤U									<u> </u>
⊤1Last:	YO	310n	320n	330n	340n	350n	360n	370n	380n	390n	400n
_		500eV-									
?_si_tr0_wsf_ascii_fast/network/0(v)	0V	0¥									
		-1.0Y									
-0		100uR-			450						
rU_wst_ascii_tast/network/i(vclk2)(i)	LAU	-10008	50n	100n	150n	200n	250n	300n	350n	400n	450n
											<u>_</u> _
AlLast:	Y0		100K	200K	300K	400K	500K	600K	700K	800K	900K
/3_csdf_ac0/FREQUENCY	1.02654e+01	500K		· 	<u> </u>	<u>`</u>					-
											· ·
$/3 \operatorname{csdf} \operatorname{ac0}/(v_{\rm v} \operatorname{v1i179})(\operatorname{imag})(i)$	-1.42730nA	OH -									
75_6301_acon(v_x1173)(Imag)(I)	-1.427 JUNA	-50nff 400-0									
		200nn -									
/3_csdf_acf//(v_x1i179)(magn)(i)	1.42747nA	100nA	100K	200K	300K	400K	500K	600K	700K	800K	900K

At this point we have a digital, Verilog, waveform file in vWave, an analog *.tran file in vWave, and a *ac0 file in vWave. Users can use the middle mouse button to drag any signal name in any pane to any other pane that has the same horizontal scale to display this signal in that pane. Next load in a *.dc0 file by selecting and loading this file as shown below:

Open Dur	mp File _ 🗆 🗙							
Filter								
nome/demo/distributions/ut2k10.1.8/examples/analog/*								
Directories	Files							
xamples/analog/.	anja.dump.fast							
xamples/analog/macro								
	csdf.tr0.fast							
	dunp.vcd							
Add To Open Files	Start Interactive Tool							
Create & I	Load Fast File							
Selection 10/distributions/ut2k10.	1.8/examples/analog/csdf.dc0]							
Open Filter	Cancel Help							

Select the csdf.dc0 file as shown above and press "Add to Open Files". Next select the signals from this csdf.dc0 file as shown below.

vWave /home/demo/dist	tributions/ut2k1	0.1.8/example	s/analog/anja.du	mp.fast - Versi	on 2010.1.8 V	Ved Jun 22 04	4:31:06 2016	_
File Format Options Window Tools Help	X0=10.2654							
19 🔥 🗈 😁 🖑 🔅 🗳 🗠 📭	Big war war war	. <u>19</u> 199 199 1	🛒 💷 🔍 🔽 🤻	🖢 🚖 👫 🗱 🚺	두 🔅 🚥 炎	l 🏹 🔍		
⊤ ₿Last: <u></u>	310n	320n	330n 340n	350n	360n	370n	380n	390n 400n
/1 anja dump fast/s85/intr 0								
/1_anja_dump_fast/s85/iomout x								
/1_anja_dump_fast/s85/nreset 0	0	100u	200u 300u	400u	500u	600u	700u 80	i0u 900u
/1 ania dumn fast/s85/nclock 0								
T3Last: V0	310n	320n	330n 340n	350n	360n	370n	380n	390n 400n
r0_wsf_ascii_fast/network/l(vclk2)(i) 0A	0A							
	-100uA - 0	50n	100n 150	n 200n	250n	300n	350n	400n 450n
	500ŭi 🖂							
AlLast: VO		100K 2	00K 300K	400K	500K	600K	700K 80	DK 900K
/3_csdf_ac0/FREQUENCY 1.02654e+01	500K-		·					
/3_csdf_ac0/l(v_x1i179)(imag)(i) -1.42730nA	0	· · ·						
	-100nA	<u> </u>						:
/3 csdf ac0/((v x1i179)(magn)(i) 1.42747pA	200n8 150nA 100nA	100K	200K 300K	400K	500K	600K	700K 80	0K 900K
								IZ
n 🖓 🕬 ∿ 🔨 🛴 🖓 /4_csdf_dc0 (csc	st.dcU)							
Modules: Filter	Variables: Filte	n I						
xcnp2 xq3 xqp1 xqpd xrbgd x11213 xq1 xq4 xqp2 xqsu xrbgu xcnp1 xq2 xq5 xqp3	I(ug)(i) I(urin)(i) I(uv)(i) V(11:d4)(u) V(11:n1)(u)	V(11:n1n31)(v) V(11:n6)(v) V(20:cin)(v) V(24:cin)(v) V(34:cin)(v)	Y(38:cin)(v) Y(a1)(v) Y(g)(v) Y(n1n136)(v) Y(n1n169)(v)	V(n1n206)(v) V(n1n207)(v) V(n1n224)(v) V(n1n243)(v) V(n1n243)(v)	V(n1n274)(v) V(n1n283)(v) V(n1n287)(v) V(n1n289)(v) V(n1n300)(v)	V(n1n304)(v) V(nbi)(v) V(pbi)(v) V(rin)(v) V(tap)(v)) V(uv1)(v) V(uv1)(v) V(v)(v) V(vbg)(v) V(vc1)(v)	V(vc2)(v) i(r4)(i) i1(nnnb2)(i) i1(nnnbg)(i) temperature

Before pressing Display, add a new pane with an Arbitrary horizontal scale as follows;

Window -> Panes -> Add New Pane, Arbitrary X

		VW	ave /ho	me/de	mo/dist	tributio	ns/	ut2k1	0.1.8	/exa	mples	s/anal	og/anj	ja.dum	p.fas	st -
Fil	e Format	Options	Hindow	Tools	Help											
A B⇔∎	🔥 🗈	🚖 🦽 📩	Config	uration				a .a	$\sim \sim $	n or	~~~ n	R	Q [~ ب		? 01 XZ
	Last:		Naviga	tor			2		150	'n		200	n		250n	
	<u></u> a		Cursor	s			\geq				1 1 1 1				1 1 1	
	/1_anj	a_dump_fa	Lock C	ursor,	Selecte	d Signal	>									
	/1_anja_	_dump_fast/	Annota	te Have	forns		>									
/1_	_anja_dump	p_fast/s85/c	Tags				>									
	/1_anja	_dump_fast	Fit To	Pane												
	/1_anj	a_dump_fa:	Horizo	ntal Sc	rolling		>									
	/1_anja_d	lump_fast/s	Vertic	al Scro	olling		>									
	/1_anja_c	lump_fast/s	Set Di	splay I	[nterval											
	/1_anja_c	lump_fast/s	X Axis	- Log	Scale											
	/1_anja	_dump_fast	F Auto U	pdate												
	/1_anja_	dump_fast/:	E Show C	omplete	e Signal	Nane										
			Real T	ine			>	A				· / /				
r0_w	/sf_ascii_fa	ast/network/	Time S	cale	•			<u>`</u>								
			Havefo	rn Heig	hts					Y				V		
			Panes				P -									
_wst	_ascii_tast	network/I(\	Value	Areas			돈분	Add New	Pane	, Ti	ne					
			Floati	ng Wind	lous		\geq	Add New	i Pane	e, Ar	bitrar	у×				
-0 w	sf ascii fa	st/network/	(vload)(i)		ΠA			Kenove	Pane							
0_**	or_ason_ra	our not worker	.((),(),(),(),(),(),(),(),(),(),(),(),(),		0	-5008-		Sync Pa	nes			~				
						1.0u8										
J_ws	sf_ascii_fas	st/network/l((vreset)(i)		0A	500nA-	0	1	- 10)Ûu		200u		300u		400
											1		1			

Then press Display, the resultant vWave display is shown below:

vWave /home/dem	o/distributions/ut2k1	0.1.8/exampl	es/analog/anja.	dump.fast - Vers	ion 2010.1.8 V	Ved Jun 22 C	04:31:06 201	6	_ ¤ ×
File Format Options Window Tools	Help								
🎥 🚴 🗈 😁 🖑 👯 🔊 🗠 🚦	e 📑 📴 🙀 🙀 🙀	<u>~~~~~~~~~</u>	🕵 💷 🍳 之	🔨 👌 👬 暮	독 🔅 📼 炎	. 💓 🔍			
TBLast: VO	310n	320n	330n 34)n 350n	360n	370n	380n	390n	400n
/1 ania dump_fast/s85/intr									
/1_anja_dump_fast/s85/iomout	x								
/1_anja_dump_fast/s85/nreset	0	100u	200u 30	0u 400u	500u	600u	700u	800u	900u
/1 ania dumn fast/s85/nclock									
⊤∃Last: <u>U</u> Y0	310n	320n	330n 34)n 350n	360n	370n	380n	390n	400n
r0_wsf_ascii_fast/network/I(vclk2)(i)	0A 08-								
	50008 0	50n	100n :	50n 200n	250n	300n	350n	400n	450n
									-
A 1 Last: <u>V</u> YO		100K	200K 300I	400K	500K	600K	700K	800K	900K
/3_csdf_ac0/EBEQUENCY1.0265	4e+01 500K-					<u> </u>			
	0								
10 K 01K 1170X 10 1 10	0A								— <u>·</u>
/3_csdf_acU/I(v_x11179)(imag)(i) -1.42	-50nA -50nA -								· ·
	200n8 - 200n8 -	100K	200K 30	0K 400K	500K	600K	200K	800K	900K
/3_cedf_ac0/l/v_v1i179)(magn)(i) 1.42	747pA 100nA								(>
Display Mt 1 18 A 14 csdf d	c0 (csdf.dc0)								
Hodules: Filter	Variablest Filte	r I							
•• xcmp2 xq3 xqp1 xqpd xrbgc	1 [(vg)(i)	¥(11:n1n31)(v	y(38:cin)(y)	¥(n1n206)(v)	¥(n1n274)(v)	¥(n1n304)(v) ¥(uv1)(v) V	(vc2)(v)
x1i213 xq1 xq4 xqp2 xqsu xrbgu xcmp1 xq2 xq5 xqp3	J I(vrin)(i) I(vv)(i)	¥(11:n6)(v) ¥(20:cin)(v)	¥(a1)(v) ¥(g)(v)	¥(n1n207)(v) ¥(n1n224)(v)	¥(n1n283)(v) ¥(n1n287)(v)	Y(nbi)(v) Y(pbi)(v)	¥(uvl)(¥(v)(v)	v) i i	(r4)(i) 1(mnnb2)(i)
	V(11:d4)(v) V(11:n1)(v)	¥(24:cin)(v) ¥(34:cin)(v)	¥(n1n136)(v) ¥(n1n169)(v)	¥(n1n243)(v) ¥(n1n245)(v)	¥(n1n289)(v) ¥(n1n300)(v)	Y(rin)(v) Y(tap)(v)	¥(vbg)(¥(vc1)(v) i v) t	1(mnnbg)(i) emperature

The bottom pane holds the just added csdf.dc0 file, the csfddf.ac0 has been taken out to allow room to display the csdf.dc0 file. When users are adding new panes, if there are too many panes to fit the current display area, the vWave will automatically scroll the new pane so it is visible. Users can scroll up or down to see all of the current panes in vWave.

As part of the vWave waveform display software, users have a very complete set of analog analysis features.

As shown below first select the signal you want to analyze.

vWave /hor	me/demo/distribu	tions/ut2k10.1.8	/examples/analog	g/anja.dump.f	ast - Version	2010.1.8 T	hu Jun 23 04	4:06:26 2016		_ 🗆 ×
File Format Options Window	Tools Help									
📲 👗 🖻 😁 🖑 🍀 省 🛩) 🔁 📴 📬 🖬	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	<u> </u>	रे 🗠 🦴 🤺	? ⁰¹ 🐉 🎼	👬 📼 炎	يە 🖉			
⊤8Last:	YO	150	n 200n	250)n 	300n	350n	400n	450n	
/1_anja_uump_rasvsoJ/muu	0									Δ
/1_anja_dump_fast/s85/iomout	U Y									_
		- <u>k</u>	· h		k		· /		1.	
r0_wsf_ascii_fast/network/l(vclk2)(i)	DA OF	/(٦/٨		/(·····	/(/(_
	-100uf		Y							
und post factor to all (forder and (f)	-5000 100.000-0-1-00	0 100)u 200u	300u	400u	500u	600u	700u	800u 900u	
	⊲ ⊺≥1.5⊓	বা								
A 1 Last:	YO	100K	200K	300K	400K	500K	600K	700K	800K 900K	
										<u> </u>
/4_csdf_ac0/FREQUENCY	1.01243e+01 500k	· ·	·							_
	0									
/4_csdf_ac0/I(v_x1i179)(imag)(i)	-1.40768nA -50nf	£ .								
	-100nA	Ĺ.								
14 K 04K 11170X 140	200n 150n	L .			400K	5004	FOOR	7004	900K 900K	V
74_csdf_acU/I(V_X11179)(magh)(I)	1.40785NA 100nH		2006	300K	400K	500K	BOOK	700K	100K 300K	- 12
	Y0 1	_40 _30	-20 -10	0	10 20	30	40	50	60 20	80
	10	40 30	10	· · ·	10 10	30		30		00
$\sqrt{5} \operatorname{csdf} \operatorname{dc}\mathbb{Q}((\operatorname{win})(i))$	-1 36919nA									
	-1,5nf									•
Ā	32544	- ·								
/5_csdf_dc0/V(11:n1n31)(v)	2.82542V									
M k	25204							-		
(E and do04/(11/06)())	1 0466714668	-40 -30	-20 -10	0	10 2	30	40	50	60 70	80

Then zoom into the area of the signal that you wish to analyze. Again with right mouse button, press down and slide down and to the right over the area of the signal you want more detail on.

Set the t0 mouse cursor on the left point of the area you want to analyze and then set the t1 cursor, the middle mouse, on the right side of the area you want to analyze, as shown below:

vWave /ho	me/demo/dist	ributions/ut2k	10.1.8/exa	mples/analog	ı/anja.dum	p.fast - Ver	sion 2010.1.	8 Thu Jun 23	04:06:26 20	16		
File Format Options Window	Tools Help	<0=30.0786 <mark>×0</mark> -× ¥0=2 .82543¥ ¥0−¥	1=4.94144× 1=9.77911u ¥	(1=35.0200 V1=2.82544V								
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r0_wsf_ascii_fast/network/l(vclk2)(i)	1 0A -1	LOOUA OA LOOUA -	· · ·	<u>:</u> /		:)	L.Ξγ	<u>`</u> _/			_ ∧ :	
wef_aceji_fact/actuark/l(v/deua)(i)		50008 Leona Leona </td <td>100u</td> <td>200u</td> <td>300u</td> <td>400u</td> <td>500u</td> <td>600u</td> <td>700u</td> <td>800u</td> <td>900u</td> <td></td>	100u	200u	300u	400u	500u	600u	700u	800u	900u	
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X A	25 25	5430V	-30	-20 -10	0	10	20	30 40	50	60	70	80

Next open the drop down menu for Analog Analyzer, and then select "Rise Time Analyzer" as follows;

Tools -> Analog Analyzer -> Rise Time Analyzer

and shown below:



The resultant rise time will be displayed in the Rise Time Analyzer window shown below:

Rise Time A	nalyzer _ 🗆 ×
File Edit Options Window	Help
🎥 🔥 🖹 😁 🥓	
Selected Signal:	Color:
clkn(v)	A LightPink A LineGreen HediumSpringGreen B CadetBlue LightPink1 A
<u>م</u>	
žeory	
Lo Thresh: 20%	Hi Thresh: 80%
Start Time: 245.158001n	End Time: 246.777001n
RT Table: [Signal Time Rise-	-Time Count]
/3_si_tr0_wsf_ascii_fast/network/clkm(v) [245.380251n 555.8906273p
4	
Apply	Close

vWave also provides hundreds of analog analysis functions in the menu seletcion, "Analog Functgions". To use these functions do the following to select the Analog Functions:

Tools -> Analaog analyzer -> Analaog Functions ...

🐝 Applications Places System 🍪 汤 🗾			
vWave /home/demo/distributions/	ut2k10.1.8/examples/analog/anja.dump.	fast - Version 2010.1.8	8 Thu Jur
File Format Options Window Tools Help			
📲 🔥 📄 📥 🤲 🍀 🍟 🗳 VeritoolsVerifyer	ब 👷 🕂 🛒 🕵 🖼 🔍 之 🔨 👌	? 🛟 🗿 🔽 👬 👬	🖉 👰 🤇
T16 Last: [] Test Analyzer	150n 200n	250n 300n	
Schematic	Y		
Control Flow Graph	λ · ' · · λ '·	<u></u> и -	
r0_wsf_ascii_fast/network/l(vclk2)(i) Logic Analyzer	·/۱٬	/\	\
Toggle Analyzer	· · · · · · · · · · · · · · · · · · ·		ų
Sequence Analyzer			
_wsf_ascii_fast/network/l(vddsup)(i) Analog Analyzer			
State Tool	Contiguration		
Script Tool	Show Alstogram		
C_wsi_asci_iasvietworki(vioad)(i, Caliper Tool	<pre>/ Interpolate furcent</pre>	400u 500u	600u
	F Auto Color Haveforms		
	Measure		
	Pane Zoom Analog		
Modules: Filter Variables	Overlay Waveforms		
···	Convert To Digital	*i3y(v) i9y((v)
*I(VCIR2) *I(vddsup	Calculate Average	*169(V) 10(v *17y(v) 10ac	// 1(v)
	Calculate Slope		
	Eye Diagram Analyzer 🔋 😕		
	Rise Time Analyzer		
	Fall Time Analyzer		
	Pulse Width Analyzer		
	Analog Functions		
hکا	Analog Functions, Edit Selected		
Dialog box appears: "Open Dump File"	Selected Analog Waveform Properties		
Select vt dump	Measure		

As shown below there are hundreds of avaialble analog functions users have with vWave when analysizing their analog design, functions that can be combined with the operators "+","-", "*", "/", "<", ">" to make even more complex functions which can be saved if they are going to be used more than once.

				Anal	og Functions				
File Edit	Options	Hindow							
😽 🗼 🗎	👌 🤌	Q							
Operators			Functions						
+ - *	/ <	>	() ABS ACOS ACOSH ACOSPI AMPS ASIN ASINH ASINPI ATAN ATANH ATANH	AVERAGE BESSEL BUTTERHORTH CBRT CHEBYSHEV1 CHEBYSHEV2 COEFFS COMPLEX COS COSH COSPI DB10 DB20	DEGREES DFT DFT_FREQ_MAGN DFT_FREQ_PHASE DFT_INDEX_MAGN DFT_INDEX_PHASE DFT_PERIOD_MAGN DFT_PERIOD_MASE DIFF DUTY_CYCLE_VS_TIME ELLIPTIC ERF ERFC	EXP EXP2 EXP10 FFT FFT_FREQ_MAGN FFT_FREQ_PHASE FFT_INDEX_MAGN FFT_PERIOD_MAGN FFT_PERIOD_MAGN FFT_PERIOD_PHASE FIR FREQ_VS_TIME IDFT	IFFT IIR IMAG INTEG JITTER_VS_TIME LOG LOG2 LOG10 MAGN MAX MIN PERIOD_VS_TIME PHASE	PLOTXY POH REAL RMS SIN SINH SINPI SQRT TAN TANH TANPI YOLTS HATTS	
Nane:									
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Analog expres	Analog expression:								
Ĭ									
N			Apply				Close		

To demonstrate these functions, we will add two signals together and add this new signal back to the display window;

Drag the signal names you want to add together from the waveform display to the Analog Expression area of the Analog functions window. Then select the "+", operator, and place this operator between the signal names. Next provide a new signal name in "Name" area of this window for this new signal,

Analog Functions _ 🗆 🗙								
File Edit Option	ns Hindow				Help			
📲 诸 🖻 😕 🥖	P Q							
Operators	Functions							
+ _ * / <	<pre>< \ \ \ \ \ \ \ \ \ \ \ \ \</pre>	AVERAGE DEGREI BESSEL DFT BUTTERNORTH DFT_FI CBRT DFT_TI CHEBYSHEV1 DFT_TI CHEBYSHEV2 DFT_TI COEFFS DFT_PI CONPLEX DFT_PI COSH DUTY_I COSFI ELLIP DB10 ERF DB20 ERFC	ES EXP EXP2 EQ_HAGN EXP10 REQ_PHASE FFT IDEX_MAGN FFT_FREQ_HAGN IDEX_PHASE FFT_FREQ_PHASE FRIOD_HAGN FFT_INDEX_MAGN FRIOD_HAGN FFT_INDEX_MAGN FRIOD_HASE FFT_PERIOD_PHASE IC FIR FTC_PERIOD_PHASE IC FIR FREQ_VS_TIME IDFT	IFFT IIR IMAG INTEG JITTER_VS_TIME LOG2 LOG10 MAGN MACN MIN PERIOD_VS_TIME PHASE	PLOTXY POH REAL RHS SIN SINH SINPI SQRT TAN TANH TANH TANPI YOLTS HATTS			
Add_Two_Signals								
/2_si_tr0_wsf_ascii_fast/network/I(vclk2)(i)+ /2_si_tr0_wsf_ascii_fast/network/I(vclk2)(i)]								
	Apply			Close				

When you press Apply the resultant waveform display will appear as shown below with the new signal "Add_Two_Signals":

vWave /home/demo/di	stributions/ut2k10.1.8/examples/	/analog/anja.dump.fast - Ver	sion 2010.1.8 Thu Jun 23 04:4	8:25 2016 _ 🗆 ×
File Format Options Window Tools Help				
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T 15Last: 10 YO	150n	200n 250n	300n 350n	400n 450n
/Add_Two_Signals -4.74895e-1	8	V	_/////////	v^
r0_wsf_ascii_fast/network/l(vclk2)(i) 0/	100uA - · · · · · · · · · · · · · · · · · ·	;\		∧
_wsf_ascii_fast/network/l(vddsup)(i) -193.000p/	-5000 -5	200. Z00. 400.		
	50uf 0 1000 2	2000 3000 4000		
🏧 🎭 🛝 🎲 🟒 🎉 🥀 /2_si_tr0_wsf_a	ascii_fast/network (si.tr0.wsf.ascii.fast)			
Modules: Filter	Yariables: Filter I			
	<pre>%0(v) *I(vload)(i) *clk *I(vclk2)(i) *I(vreset)(i) *clk *I(vddsup)(i) *clk2(v) *i10 </pre>	cn(u) *i11y(v) *i3y(v cs(v) *i1y(v) *i6y(v yg(v) *i25y(v) *i7y(v	v) i9y(v) reset(v) v) ld(v) vdd(v) v) lood(v) xi10.i2s	xi3,n0d(v) xi6,n0d(v) xi3,n1d(v) xi9,i2s(v)

As can be seen if the figure below the Analog functions are very extensive and include the transcendental functions, SIN, COSIN, TAN, etc., FFT and IFFT functions, DFT, GUI Filter builders and many others.

		Anal	og Functions				_ 0 X
H							Help
	Functions						
4	() ABS ACOS ACOSH ACOSPI AMPS ASIN ASINH ASINPI ATAN ATANH ATANH	AVERAGE BESSEL BUTTERHORTH CBRT CHEBYSHEV1 CHEBYSHEV2 COEFFS COMPLEX COS COSH COSPI DB10 DB20	DEGREES DFT DFT_FREQ_MAGN DFT_FREQ_PHASE DFT_INDEX_MAGN DFT_INDEX_PHASE DFT_PERIOD_MAGN DFT_PERIOD_MAGN DFT_PERIOD_PHASE DIFF DUTY_CYCLE_VS_TIME ELLIPTIC ERF ERFC	EXP EXP2 EXP10 FFT FFT_FREQ_MAGN FFT_FREQ_PHASE FFT_INDEX_MAGN FFT_INDEX_PHASE FFT_PERIOD_MAGN FFT_PERIOD_PHASE FIR FREQ_VS_TIME IDFT	IFFT IIR IMAG INTEG JITTER_VS_TIME LOG LOG2 LOG10 MAGN MAX MIN PERIOD_VS_TIME PHASE	PLOTXY POH REAL RMS SIN SINH SINPI SQRT TAN TANH TANH TANH TANPI YOLTS HATTS	

In addition to the Analog Functions, the Veritools vWave has a script tool based on Perl. Script tool is even more useful and powerful because it can extend the functions in vWave by the user using the standard Perl language, and can be used with either analog and digital analysis.

The Script tool is found in Tools -> Script tool and has the initial startup window shown below:



The Perl Operators are listed on the left side of the window, the Perl Keywords, to the immediate right of the Operators field. These are the standard Perl operators and Keywords used in standard Perl scripts. The Perl functions are listed to the immediate right of the Keywords. The Perl functions allow Perl to communicate with the vWave software.

On the right side of the scripts window is the list of the Scripts, which are the Veritools defined scripts.

In the vWave software distribution directory are three files that are used to define the Perl operations:

Undertow.pm, a file that lists the and defines the new Perl "Function" routines that connect Perl to the vWave software. For example, two of the functions are;

CloseAllFilesAndOpen(Filename) – this closes all files currently in vWave and opens and loads the file with the specified name.

CreateAnalogSignal(signal_name, expression) – creates an analog signal with the specified name using the specified analog functions expression. Any expression available in the Analog Functions window can be used in an expression for CreateAnalogSignal.

All of these functions are listed in the Perl Functions list in the Script window, and are defined as to what each function does and the inputs that are required for this function in the Undertow.pm file.

UndertowPerlUtilities.pm is a list of Perl routines that are used in building the Perl scripts in the "Scripts" list. These routines are based on standard Perl and do not require any knowledge of vWave.

UndertowAnalogExtensions.pm is a file of Perl routines used primarily for creating analog scripts. Examples are Average, FindNDBPoints, GetPeriod, GetFrequency, etc.

For example, in "FindNDBPoints", N defines a DB point the user wants to find on a signal. If N is set to a -3, this routine will find the maximum value of this signal and then find the 3DB down point on this signal from this maximum value. The routines in Undertow.pm,

UndertowPerlExtentions.pm and

UndertowAnalogExtenrtions.pm along with the Perl Operators and Keywords were used to write the Perl code for the Scripts in the Scripts list.

Scripts in the Scripts window are located with the environment variable UT_SCRIPTS_DIR, which is usually set to \$UT_ROOT_DIR/scripts, with the script routine suffix defined in the

Script_Tool -> Window -> Configure-> File Suffix: text area, currently set to ". script" Users can add their own routines to the Scripts directory, the UndertowPerlExttentions.pm and the UndertowAnalogExtentions.pm files.

Since most engineers are familiar with C programming and Perl, the Script tool allows the vWave to have unlimited extensibility defined by the user with an easy to use universal language.

The currently available Scripts are the following:

3DB.script Amplitude.script analogdev.script

AtX.script Average.script bandpass.script Baseline.script builder.script bus-interpeter.script compare_files.script compare module.script compare_module_tree.script compare_signal.script dbdown.script deltax.script DeltaX.script DeltaY.script dutycycle.script dutycycle_vs_time.script get_values.script highpass.script localmax.script localmin.script lowpass.script low_to_high.script MaxFall.script MaxPoint.script MaxRise.scrip meas gui.script measgui.script measure1.script measure.script MinPoint.script PeakToPeak.script place_tag.script

ScriptsMenu.script SlewRate.script stopband.script threshold.script Topline.script up_cvs_test.script ut.test.script xmax.script xmin.script

Examples of some of these scripts are as follows:

3DB.script

This script finds the 3 DB points with respect to maximum value point.# It selects the first point and adds the value tag to indicate that# it is the 3 DB point.

use UndertowAnalogExtension qw(FindNDBPoints GetFirstMaxPoint GoToAtTime); use UndertowPerlUtilities qw(NDBValue);

```
my(@signals, $signal, $max_point, @result);
@signals = GetSelectedSignals();
$signal = $signals[0];
```

```
$start = GetCursor(0);
$end = GetCursor(1);
print "start = $start end = $end \n";
```

\$max_point = GetFirstMaxPoint(\$signal, \$start, \$end);

@result = FindNDBPoints(\$signal, \$start, \$end, \$max_point, 3, 0);
print "3 DB points are: @result \n";

```
GoToAtTime(0, $signal, $result[0]);
PlaceValueTagUsingCursor("3 DB Point $result[0]");
```

Amplitude.script

#This script finds the amplitude of a selected signal.

use UndertowAnalogExtension qw(FindNPeaks GetFirstSameValuePoints PrintVarArray);

```
my(@signals, @data);
@signals = GetSelectedSignals();
```

```
$start = GetCursor(0);
$end = GetCursor(1);
print "start = $start end = $end \n";
```

```
print "Selected signal is $signals[0] \n";
```

```
my(@result, $top_line, $base_line, $amplitude);
@result = GetFirstSameValuePoints($signals[0], $start, $end, 1, 1);
$top_line = $result[2];
```

```
@result = FindNPeaks($signals[0], $start, $end, 2);
#PrintVarArray(@result);
$base_line = $result[9];
```

```
$amplitude = abs($top_line - $base_line);
```

print "Top line: \$top_line Base line: \$base_line Amplitude: \$amplitude
\n";