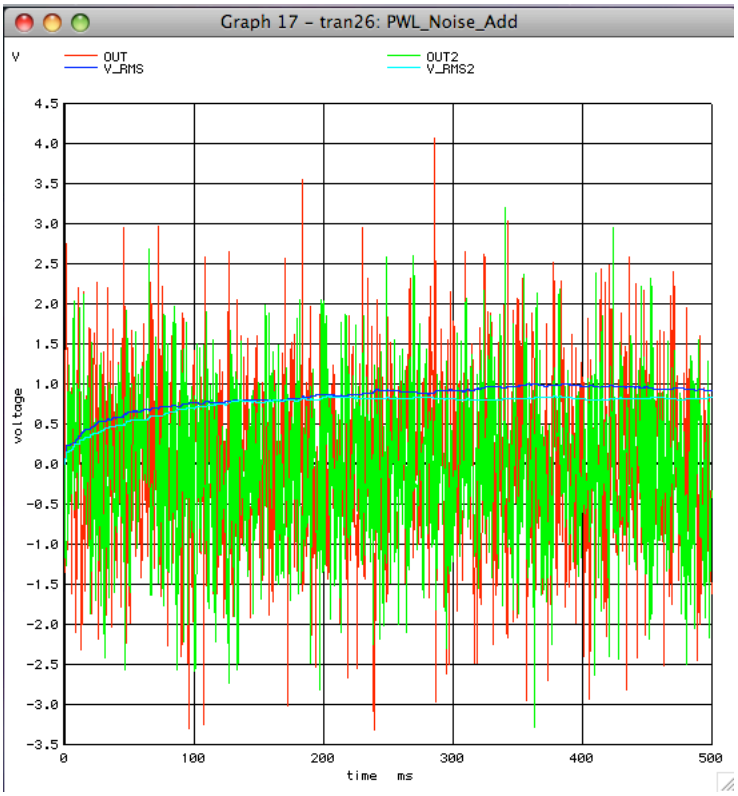
PWL_Noise_Add

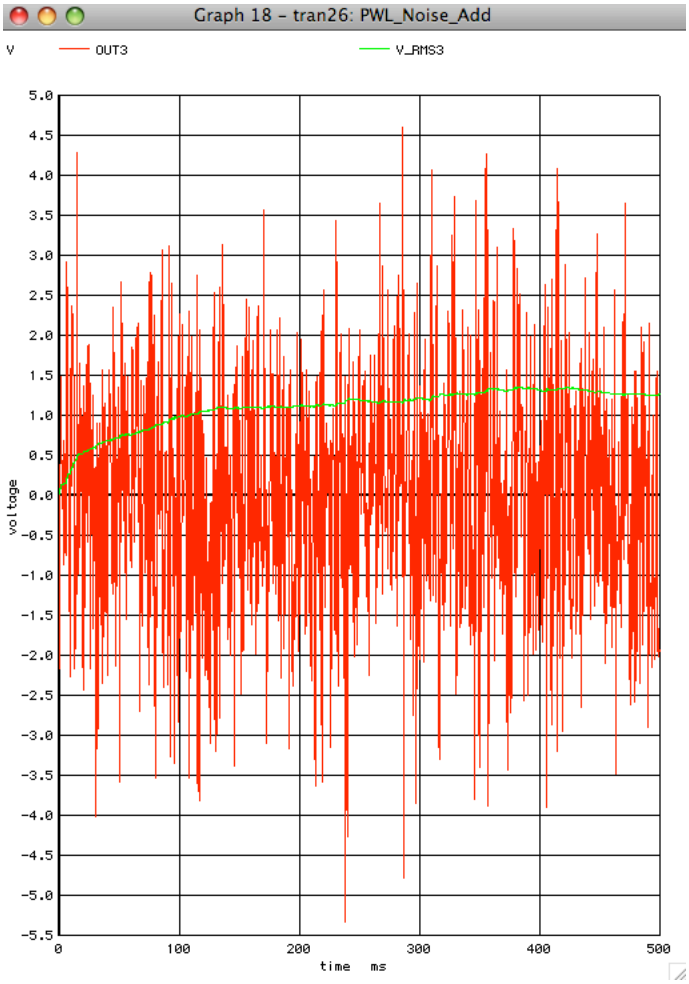
* www.idea2ic.com dsauersanjose@aol.com 4/22/08
*
* OUT RLOAD OUT2 RLOAD2 OUT3 RLOAD3
* _/\ /\ /_ _/\ /\ /_ _/\ /\ /_ ____
* | \/ \/ | | \/ \/ | | \/ \/ | OUT-> | RMS |-> V_AVE
* |__|__| |__|__| |__|__| |____| |____|-> V_RMS
* /|\ 7// /|\ 7// /|\ 7// /OUT \ B1 7// ____
* / VPWL \ / VPWL \ / + \ |____|-> V_AVE2
* \ / \ / \ OUT2 / OUT2-> | RMS |
* ____/ ____/ ____/ |____|-> V_RMS2
* | PWL_test.txt | PWL_test2.txt | ____
* | | | | |____|-> V_AVE3
* 7// 7// 7// OUT3-> | RMS |
* |____|-> V_RMS3
*
* VpwlT OUT 0 PWL(<== Format for piecewise linear file is as so.
* + 0 0.38156547 Random Noise can by a javascript calculator.
* + 1.00E-06 0.60066694 The **step of time is 0.5ms** and bandwidth
* + 2.00E-06 0.361341313 of noise will therefore be a **half of 1kHz**.
* .....etc.....
* + 0.000003 0.944365605 The **total measurement time is 500ms** which
* + 5.16E-04 0.658730205 corresponds to a **2Hz resolution**
* +)
* This text file is located at the following
* **Users/donsauer/Documents/MacSpice/PWL_test.txt**
*
* spec start_f stop_f step_f vector [vector ...]
* spec 2 2k 2 v(out) spec 2Hz->2kHz @ 2Hz steps
* .tran TSTEP TSTOP TSTART TMAX ?UIC?
*======== ====== ====== ====== ====== ====== ====== ====== ====== ====== ======

```
.include    PWL_test.txt
.include    PWL_test2.txt
Rload       OUT     0     1k
Rload2      OUT2    0     1k
Rload3      OUT3    0     1k
B1          OUT3    0     v = v(out) + v(out2)
XM_RMS   OUT     V_AVE   V_RMS    M_RMS
XM_RMS2  OUT2    V_AVE2  V_RMS2   M_RMS
XM_RMS3  OUT3    V_AVE3  V_RMS3   M_RMS

.tran     500u   500m     0     500u  UIC


**===See_Two_Random_Waveform_Sum_Together=====

.control
set  outfile =        "Noise_Waveforms.txt"
run
plot      OUT  OUT2 V_RMS  V_RMS2
plot      OUT3  V_RMS3


set n
let n = 0
set v
let v = 0
set v2
let v2 = 0
set v3
let v3 = 0

**===Print_Out_The_Results=====
repeat  4420
let n = n+1
let v  = out[n]
let v2 = out2[n]
let v3 = out3[n]
echo                    "$&v    $&v2    $&v3 " >> $outfile
endrepeat

.endc

* ========== .SUBCKT M_RMS V_IN V_AVE V_RMS  ==================
*
*  ____
*  V_IN-> | RMS |-> V_AVE
*  |____|-> V_RMS
*
*
*  Vsum Rave Vsum2 Rave2 V_RMS Rrms
*  __/\ /\ /\_ V_AVE __/\ /\ /\_ Vave2 __/\ /\ /\_
*  _|_ \/ \/ | _|_ \/ \/ | _|_ \/ \/ |
* V_IN->/ \ _|_ / \ _|_ / \ _|_
*  \___/Bsum \___/Bsum2 \___/Brms 7//
*  ___ ___ ___ ___ ___
*  | Cave | | Cave2 | |
*  7// 7// 7// 7// 7//
*
.SUBCKT M_RMS   V_IN   V_AVE V_RMS
Bsum        Vsum      0         V = v(V_IN)
Rave        Vsum      Vave      1
Cave        V_AVE     0         300m
Bsum2       Vsum2     0         V = (v(V_IN)-v(V_AVE))^2
Rave2       Vsum2     Vave2     1
Cave2       Vave2     0         100m
Brms        V_RMS     0         V = v(Vave2)^0.5
Rrms        V_RMS     V0        1k
.ENDS    M_RMS
```

```
.end

======================END_OF_SPICE============================

The total sample period is 200msec(2Hz)
Two 1Vrms noise signals were generated.
```




```
Two Noise Waveforms are generated.
```



The sum of the two is shown above.

To Sanity check the V_RMS values
The wave data is pasted into a javascript

http://www.idea2ic.com/PlayWithJavascript/RMS_DATA_OF_COLUMNS.html

Noise_Waveforms.txt

```
-2.33806    -0.806948    -3.14501
-2.3147    -0.810577    -3.12528
-2.26798    -0.817836    -3.08581
-2.17453    -0.832352    -3.00688
-1.98764    -0.861385    -2.84902
-1.61385    -0.919451    -2.5333
-0.866287    -1.03558    -1.90187
-0.0252744    -1.16623    -1.1915
-0.0777319    -1.17242    -1.25015
-0.182647    -1.1848    -1.36745
-0.392477    -1.20956    -1.60204
-0.812137    -1.25908    -2.07121
-0.844923    -1.26295    -2.10787
-0.753449    -1.26365    -2.0171
-0.5705    -1.26505    -1.83555
-0.204603    -1.26786    -1.47247
0.298507    -1.27173    -0.97322
0.254066    -1.13246    -0.878392
0.165184    -0.853921    -0.688737
-0.0125798    -0.296846    -0.309426
-0.368107    0.817302    0.449195
-0.395883    0.904345    0.508462
-0.406409    0.840433    0.434023
-0.427463    0.712609    0.285146
-0.46957    0.456962    -0.0126079
-0.527468    0.105448    -0.42202
-0.606389    0.177385    -0.429005
-0.764232    0.321258    -0.442974
```

Calculate RMS of Columns of Data

Cut and Past Data Into Text Area Below

Do the Calculations | Try_Test_Values

```
-0.934177  1.00557  0.07139
-0.712482  0.882356  0.169873
-0.269092  0.635932  0.36684
0.445049  0.239032  0.684081
1.01157  -0.0758241  0.935746
0.807489  -0.121563  0.685925
0.399326  -0.213042  0.186284
-0.416998  -0.396  -0.812998
-1.08881  -0.546568  -1.63537
```

```
3_columns    17680_rows
0.0022672877701425493   X_ave
0.8608571606024085   X_rms
-0.03752901018428732   Y_ave
0.7777965951104482   Y_rms
-0.03526168616994321   Z_ave
1.1550037349033824   Z_rms
```

* http://www.idea2ic.com/PlayWithJavascript/RandomPWL2.html

GENERATE RANDOM PWL FILE

OUT — Enter a Name

1 — Enter RMS Magnitude

2 — Enter Min Frequency

1000 — Enter Max Frequency

CreateRandomData | Clear

```
VpwlOUT  OUT 0 PWL(
+ 0.000000000000    2.176117243850604
+ 0.000500000000    0.10218877751380205
+ 0.001000000000    0.4929700750485062
+ 0.001500000000    -0.3156222347309813
+ 0.002000000000    -0.7291614662669599
+ 0.002500000000    0.7260373675916344
+ 0.003000000000    -0.818738239123486
+ 0.003500000000    -0.9821955293649807
+ 0.004000000000    -0.22994326088111847
+ 0.004500000000    1.1355155573179945
+ 0.005000000000    0.06984444539062679
+ 0.005500000000    0.45454472963232545
+ 0.006000000000    0.7739031501347199
+ 0.006500000000    2.0022723715240134
+ 0.007000000000    1.909259938742034
+ 0.007500000000    -0.033569234199821 95
+ 0.008000000000    -0.9974381188536062
+ 0.008500000000    -0.06690125706139952
+ 0.009000000000    -0.71120745155029
```

0.5 — Total Period is Now

0.0005 — Sampling Period is Now

1000 — Number Points is Now

GENERATE RANDOM PWL FILE

OUT2 Enter a Name

1 Enter RMS Magnitude

2 Enter Min Frequency

1000 Enter Max Frequency

CreateRandomData Clear

```
VpwlOUT2  OUT2 0 PWL(
+ 0.000000000000    -0.8517624540254474
+ 0.000500000000    0.03984168873634189
+ 0.001000000000    0.8015637243865057
+ 0.001500000000    -0.6371019884431735
+ 0.002000000000    0.5484771048696712
+ 0.002500000000    0.16152948603965342
+ 0.003000000000    -0.488331882962957
+ 0.003500000000    -2.430540191698819
+ 0.004000000000    2.216561216125265
+ 0.004500000000    -0.847445147302933
+ 0.005000000000    2.6603877172479407
+ 0.005500000000    -1.5462664214428514
+ 0.006000000000    1.1378159882454202
+ 0.006500000000    0.6834362116176634
+ 0.007000000000    0.7226491449214517
+ 0.007500000000    -0.9783380010025575
+ 0.008000000000    -2.3299228279525415
+ 0.008500000000    -1.3868906316859646
+ 0.009000000000    -0.3175541632482782
```

0.5 Total Period is Now

0.0005 Sampling Period is Now

1000 Number Points is Now