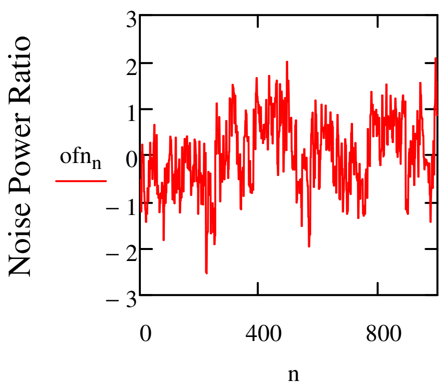
1/f Noise Using the Mathcad 15 onefn function:

ofn := onefn(1000) ofn := ofn − mean(ofn) n := 0 .. last(ofn)



Time Domain

ofn =

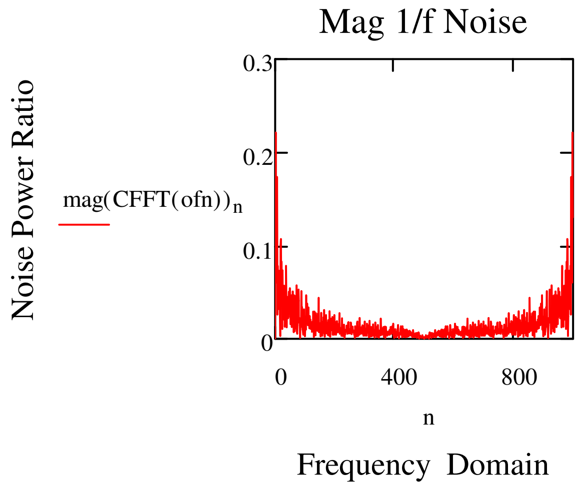
	0
0	-0.535
1	-0.535
2	-0.809
3	-0.809
4	-1.211
5	-1.211
6	0.065
7	0.065
8	0.22
9	0.22
10	-0.158
11	-0.158
12	-0.017
13	-0.017
14	-0.785
15	...

Double Entries??????

CFFT(ofn) =

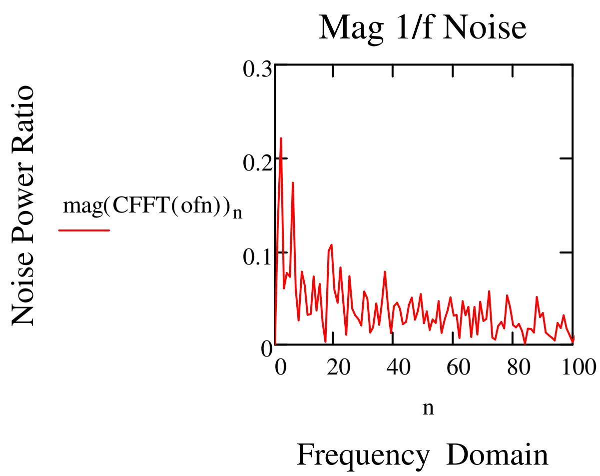
	0
0	0
1	-0.109+0.071i
2	0.067+0.211i
3	-0.054-0.026i
4	-0.075+0.015i
5	0.019-0.07i
6	0.082+0.153i
7	0.022-0.055i
8	-0.023-0.012i
9	-0.073+0.027i
10	$0.063+5.869i\cdot10^{-3}$
11	$-0.031+1.994i\cdot10^{-3}$
12	-0.026-0.019i
13	$-9.565\cdot10^{-4}-0.073i$
14	$0.036-8.056i\cdot10^{-4}$
15	...

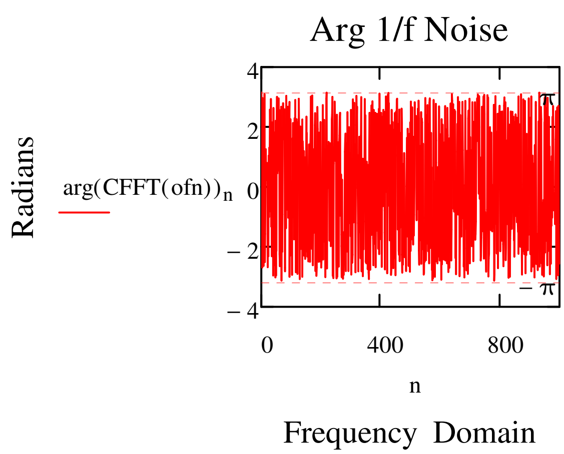
Why 0 at n = 0??????



$mag(CFFT(ofn))_0 = 0$?????

$mag(CFFT(ofn))_1 = 0.13$





Now construct a 1/f power spectrum (From Mathcad 15 Help "Noise Generators"):

As an experiment, we can try constructing a 1/f power spectrum, with random phases, and then take the inverse transform to obtain the noise vector:

$j := 1..500 \qquad i := \sqrt{-1}$

Construct the first half of the transform. A 1/f power spectrum corresponds to a 1/sqrt(f) magnitude spectrum.

$a_j := \exp(2\cdot\pi\cdot i\cdot \mathrm{rnd}(1))\cdot\frac{1}{\sqrt{j}}$ Note: Magnitude will be smooth because of 1/SQRT(j).

$a_j =$

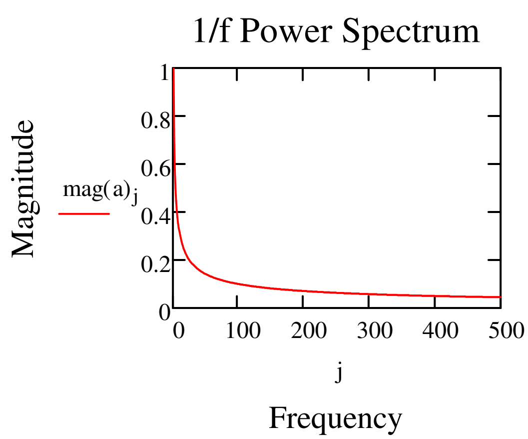
	0
0	0.667-0.745i
1	0.194+0.68i
2	0.012-0.577i
3	-0.353+0.354i
4	-0.305-0.327i
5	-0.035-0.407i
6	-0.289+0.243i
7	0.351-0.044i
8	-0.156+0.294i
9	-0.22-0.227i
10	-0.301+0.019i
11	-0.033+0.287i
12	0.254+0.11i
13	-0.256+0.076i
14	-0.156-0.206i
15	...

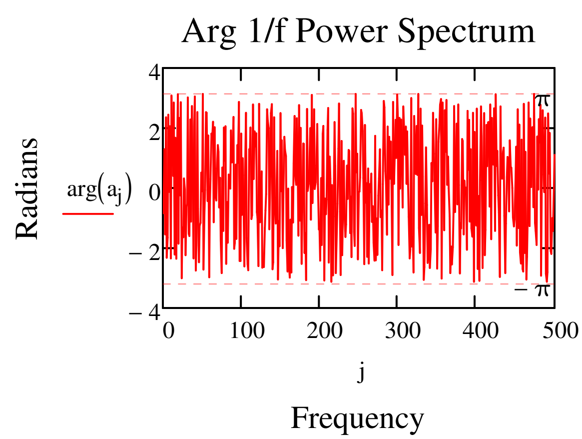
$\mathrm{mag}(a)_j =$

	0
0	1
1	0.707
2	0.577
3	0.5
4	0.447
5	0.408
6	0.378
7	0.354
8	0.333
9	0.316
10	0.302
11	0.289
12	0.277
13	0.267
14	0.258
15	...

$\arg(a_j) =$

-0.841
1.293
-1.55
2.355
-2.32
-1.657
2.442
-0.124
2.059
-2.341
3.08
1.686
0.41
2.852
-2.221
...



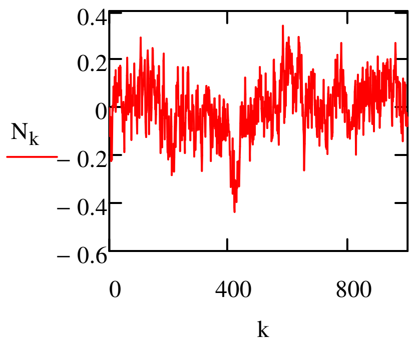


For a real signal, the second half is conjugate-symmetric around the midpoint:

$a_{1001-j} := \overline{a_j}$ The noise has mean 0: $\text{mean}(a) = -1.147 \times 10^{-3}$ roughly = 0

Transform to the time domain: $N := \text{Re}(\text{icfft}(a))$

Range for plotting: $k := 0 .. 1000$



$N_0 = -0.036$

$N_1 = -5.363 \times 10^{-3}$