# a new sort of Gaussian noise

***Source:*** http://sci.tech−archive.net/Archive/sci.fractals/2004−07/0048.html

---

***From:*** Roger L. Bagula (*rlbtftn_at_netscape.net*)
***Date:*** 07/08/04

Date: Thu, 08 Jul 2004 20:21:15 GMT

Last night I noticed that the second derivative of the projective line
was a parametric

cardioid which has genus one. I realized that I might be able to
get a new noise effect by making a random projection from the
cardioid to the real line and from there to a Gaussian noise.
It works and it apparently gives an effect much like shot noise/
tunneling effects
in transistors.
These also seems to be a cut off effect in the amplitudes which divides
them into two distinct parts.
I'm attaching both the notebook striped of pictures and pictures of the
notebook( deleted for newsgroup posts: I posted the pictures to alt.fractals)
I call the noise a martingale as that is the traditional name for
functionally random noises
different than the standard probability distributions (pdf, I hate such
abrivations).
Respectfully, Roger L. Bagula

tftn@earthlink.net, 11759Waterhill Road, Lakeside,Ca 92040−2905,tel: 619−5610814 :
URL : http://home.earthlink.net/~tftn
URL : http://victorian.fortunecity.com/carmelita/435/

(**********

Mathematica−Compatible Notebook

This notebook can be used on any computer system with Mathematica 3.0,
MathReader 3.0, or any compatible application. The data for the notebook
starts with the line of stars above.

To get the notebook into a Mathematica−compatible application, do one of
the following:

* Save the data starting with the line of stars above into a file
with a name ending in .nb, then open the file inside the application;

```
* Copy the data starting with the line of stars above to the
  clipboard, then use the Paste menu command inside the application.

Data for notebooks contains only printable 7−bit ASCII and can be
sent directly in email or through ftp in text mode. Newlines can be
CR, LF or CRLF (Unix, Macintosh or MS−DOS style).

NOTE: If you modify the data for this notebook not in a Mathematica−
compatible application, you must delete the line below containing the
word CacheID, otherwise Mathematica−compatible applications may try to
use invalid cache data.

For more information on notebooks and Mathematica−compatible
applications, contact Wolfram Research:
  web: http://www.wolfram.com
  email: info@wolfram.com
  phone: +1−217−398−0700 (U.S.)

Notebook reader applications are available free of charge from
Wolfram Research.
**********************************************************************)

(*CacheID: 232*)

(*NotebookFileLineBreakTest
NotebookFileLineBreakTest*)
(*NotebookOptionsPosition[ 5498, 191]*)
(*NotebookOutlinePosition[ 6395, 220]*)
(* CellTagsIndexPosition[ 6351, 216]*)
(*WindowFrame−>Normal*)

Notebook[{
Cell[BoxData[
    \(Clear[x, a]\)], "Input"],

Cell[BoxData[
    \( (*\
      adding\ a\ genus\ \((\ g = 1\ Cardioid)\)\ effect\ to\ a\ noise\ as\ a\
        martingale*) \)], "Input"],

Cell[BoxData[
    \( (*\ seems\ to\ simulate\ effects\ like\ shot\ noise\ in\ transisters*)
      \)], "Input"],

Cell[BoxData[
    \( (*\ by\ Roger\ L . \ Bagula\ 8\ july\ 2004 \[Copyright]\ *) \)],
  "Input"],

Cell[BoxData[
    \( (*\ second\ derivative\ of\ projective\ line\ is\ a\ Cardioid*) \)],
  "Input"],
```

```
Cell[BoxData[
   \(\(x2[s_] = \(4\ \((\(−1\) + 3\ s\^2)\)\)\/\((1 + s\^2)\)\^3; \)\)], 
  "Input"], 

Cell[BoxData[
   \(\(y2[s_] = \(4\ s\ \((\(−3\) + s\^2)\)\)\/\((1 + s\^2)\)\^3; \)\)], 
  "Input"], 

Cell[BoxData[
   \(\(r4 = Simplify[x2[s]^2 + y2[s]^2]; \)\)], "Input"], 

Cell[BoxData[
   \(\(g3 = ParametricPlot[{x2[s], y2[s]}, {s, \(−10\), 10}]; \)\)], "Input"], 

Cell[BoxData[
   \(\(g4 = 
     ParametricPlot[{2*\((1 − 1.25*Cos[s])\)*Cos[s] + 0.5, 
        2*\((1 − 1.25*Cos[s])\)*Sin[s]}, {s, \(−10\), 10}]; \)\)], "Input"], 

Cell[BoxData[
   \(Show[g3, g4]\)], "Input"], 

Cell[BoxData[
   \( (*\ solution\ of\ approximate\ cardioid\ in\ s*) \)], "Input"], 

Cell[BoxData[
   \(Solve[
     2*\((1 − 1.25*a)\)*b*\((1 + s\^2)\)\^3 − 4\ s\ \((\(−3\) + s\^2)\) == 
       0, s]\)], "Input"], 

Cell[BoxData[
   \( (*\ 
     function\ made\ from\ solutions\ as\ the\ projective\ line\ of\ a\ 
       \(cardioid : \ 
         second\ function\ taken\ as\ closer\ to\ the\ cardioid\)*) \)], 
  "Input"], 

Cell[BoxData[
   \(s[a_, b_] = 
     Root[\(−0.8`\)\ b + 1.`\ a\ b − 4.80000000000000071`\ #1 − 
          2.40000000000000035`\ b\ #1\^2 + 3.`\ a\ b\ #1\^2 + 
          1.60000000000000008`\ #1\^3 − 2.40000000000000035`\ b\ #1\^4 + 
          3.`\ a\ b\ #1\^4 − 0.8`\ b\ #1\^6 + 1.`\ a\ b\ #1\^6&, 1]; \)\)], 
  "Input"], 

Cell[BoxData[
   \(Plot[s[Cos[2*Pi*t], Sin[2*Pi*t]], {t, \(−1\), 1}]\)], "Input"], 

Cell[BoxData[
   \( (*\ 
     plot\ of\ line\ random\ to\ Gaussian\ distribution\ height\ at\ that\ 
```

```
        point\ on\ the\ line\ of\ a\ Cardioid\ random\ instead\ of\ a\
        \(circle\ : \ a\) = \ Cos[2*Pi*Random[]], b = Sin[2*Pi*Random[]]*)
    \)], "Input"],

Cell[BoxData[
   \( (*\ Gauss_dist[] = Exp[\(−s[a, b]^2\)/2]/Sqrt[2*Pi]\ *) \)], "Input"],

Cell[BoxData[
   \(SeedRandom[]\)], "Input"],

Cell[BoxData[
   \(\(noise =
     Table[Re[Exp[\(−s[Cos[2*Pi*Random[]], Sin[2*Pi*Random[]]]^2\)/2]/
          Sqrt[2*Pi]], {n, 1, 500}]; \)\)], "Input"],

Cell[BoxData[
   \(ListPlot[noise, PlotRange −> All, \ PlotJoined −> \ True]\)], "Input"],

Cell[BoxData[
   \(\(noiseI =
     Table[Im[Exp[\(−s[Cos[2*Pi*Random[]], Sin[2*Pi*Random[]]]^2\)/2]/
          Sqrt[2*Pi]], {n, 1, 500}]; \)\)], "Input"],

Cell[BoxData[
   \(ListPlot[noiseI, PlotRange −> All, \ PlotJoined −> \ True]\)], "Input"],

Cell[BoxData[
   \(\(noiseAbs =
     Table[Abs[
        Exp[\(−s[Cos[2*Pi*Random[]], Sin[2*Pi*Random[]]]^2\)/2]/
          Sqrt[2*Pi]], {n, 1, 500}]; \)\)], "Input"],

Cell[BoxData[
   \(ListPlot[noiseAbs, PlotRange −> All, \ PlotJoined −> \ True]\)], "Input"],

Cell[BoxData[
   \(\(ba = Table[Floor[2500*noiseAbs[\([n]\)]], {n, 1, 500}]; \)\)], "Input"],

Cell[CellGroupData[{

Cell[BoxData[
   \(b0 = \(Dimensions[ba]\)[\([1]\)]\)], "Input"],

Cell[BoxData[
   \(500\)], "Output"]
}, Open ]],

Cell[CellGroupData[{

Cell[BoxData[
   \(bmax = Max[ba]\)], "Input"],
```

```
Cell[BoxData[
   \(4252\)], "Output"]
}, Open ]],

Cell[CellGroupData[{

Cell[BoxData[
   \(bmin = Min[ba]\)], "Input"],

Cell[BoxData[
   \(0\)], "Output"]
}, Open ]],

Cell[BoxData[
   \(\(c = Table[Count[ba, n], {n, Floor[bmin], bmax}]; \)\)], "Input"],

Cell[BoxData[
   \(ListPlot[c, PlotJoined -> True]\)], "Input"]
},
FrontEndVersion->"Macintosh 3.0",
ScreenRectangle->{{0, 1920}, {0, 1060}},
WindowSize->{1294, 878},
WindowMargins->{{72, Automatic}, {Automatic, 13}},
PrintingCopies->1,
PrintingPageRange->{1, Automatic},
MacintoshSystemPageSetup->"\<\
00/0004/0B`000003509H?ocokD"
]

(**********************************************************************
Cached data follows. If you edit this Notebook file directly, not using
Mathematica, you must remove the line containing CacheID at the top of
the file. The cache data will then be recreated when you save this file
from within Mathematica.
**********************************************************************)

(*CellTagsOutline
CellTagsIndex->{}
*)

(*CellTagsIndex
CellTagsIndex->{}
*)

(*NotebookFileOutline
Notebook[{
Cell[1709, 49, 44, 1, 27, "Input"],
Cell[1756, 52, 139, 3, 27, "Input"],
Cell[1898, 57, 112, 2, 27, "Input"],
Cell[2013, 61, 98, 2, 27, "Input"],
Cell[2114, 65, 101, 2, 27, "Input"],
```

```
Cell[2218, 69, 99, 2, 47, "Input"],
Cell[2320, 73, 99, 2, 47, "Input"],
Cell[2422, 77, 71, 1, 27, "Input"],
Cell[2496, 80, 92, 1, 27, "Input"],
Cell[2591, 83, 166, 3, 27, "Input"],
Cell[2760, 88, 45, 1, 27, "Input"],
Cell[2808, 91, 83, 1, 27, "Input"],
Cell[2894, 94, 130, 3, 32, "Input"],
Cell[3027, 99, 209, 5, 27, "Input"],
Cell[3239, 106, 331, 6, 66, "Input"],
Cell[3573, 114, 82, 1, 27, "Input"],
Cell[3658, 117, 275, 5, 43, "Input"],
Cell[3936, 124, 90, 1, 27, "Input"],
Cell[4029, 127, 45, 1, 27, "Input"],
Cell[4077, 130, 157, 3, 27, "Input"],
Cell[4237, 135, 90, 1, 27, "Input"],
Cell[4330, 138, 158, 3, 27, "Input"],
Cell[4491, 143, 91, 1, 27, "Input"],
Cell[4585, 146, 172, 4, 27, "Input"],
Cell[4760, 152, 93, 1, 27, "Input"],
Cell[4856, 155, 93, 1, 27, "Input"],

Cell[CellGroupData[{
Cell[4974, 160, 65, 1, 27, "Input"],
Cell[5042, 163, 37, 1, 26, "Output"]
}, Open ]],

Cell[CellGroupData[{
Cell[5116, 169, 47, 1, 27, "Input"],
Cell[5166, 172, 38, 1, 26, "Output"]
}, Open ]],

Cell[CellGroupData[{
Cell[5241, 178, 47, 1, 27, "Input"],
Cell[5291, 181, 35, 1, 26, "Output"]
}, Open ]],
Cell[5341, 185, 86, 1, 27, "Input"],
Cell[5430, 188, 64, 1, 27, "Input"]
}
]
*)

(*******************************************************************************
End of Mathematica Notebook file.
*******************************************************************************)
```

--
Respectfully, Roger L. Bagula
tftn@earthlink.net, 11759Waterhill Road, Lakeside,Ca 92040-2905,tel: 619-5610814 :
URL :  http://home.earthlink.net/~tftn
URL :  http://victorian.fortunecity.com/carmelita/435/
--

Respectfully, Roger L. Bagula
tftn@earthlink.net, 11759Waterhill Road, Lakeside,Ca 92040−2905,tel: 619−5610814 :
URL : http://home.earthlink.net/~tftn
URL : http://victorian.fortunecity.com/carmelita/435/