Fourier:
Analysis & Transforms

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April 21, 2015

Results

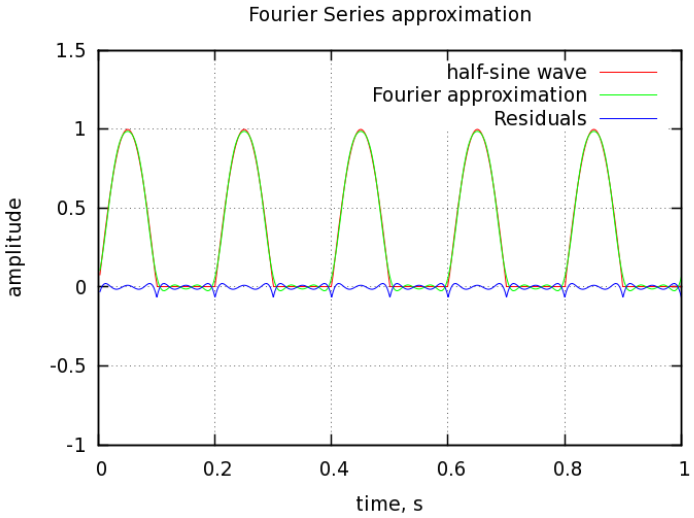

Figure 1: *Graph of half-sine wave, fourier approximation, and residuals*

To generate the fourier approximation of the half-sine wave graph a series was summed. A four term series had coefficients of: $a0 = \frac{2}{\pi} \approx 0.6366198$
entered cosine parameters (in order): [0, $-\frac{2}{3\pi}$, 0, $-\frac{2}{15\pi}$] $\approx$ [0, -0.21221, 0, -0.042441]
entered sine parameters (in order): [0.5, 0, 0, 0]

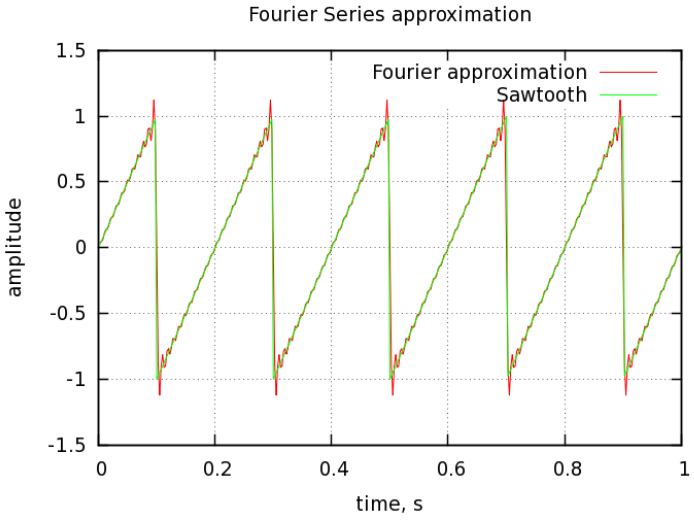

Figure 2: *Graph of sawtooth function with fourier approximation*

To generate the fourier approximation of the sawtooth function a series was summed:

$$y(t) = \frac{2}{\pi}[sin(\omega t) - \frac{1}{2}sin(2\omega t) + \frac{1}{3}sin(3\omega t) - ...]$$

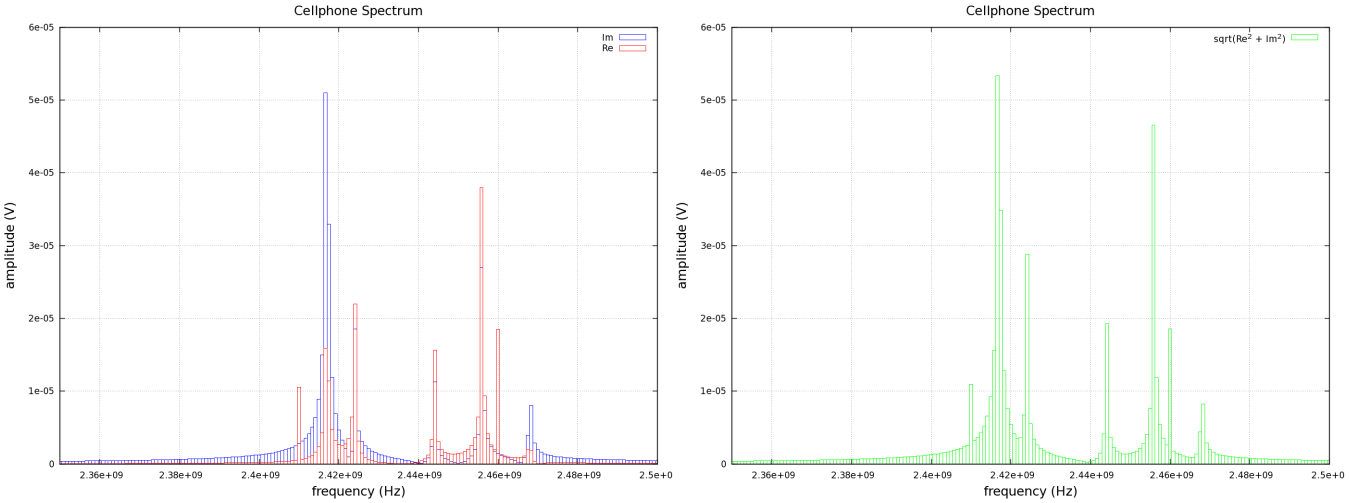

Figure 3: *Discrete fourier transform of cellphone data*

The figure on the left displays the real and imaginary component while the figure on the right graphs the magnitude (amplitude) of the fourier component is given by:

$$|A(\omega)| \;=\; \sqrt{[Re(F(\omega))]^2 + [Im(F(\omega))]^2}$$

These figures were generated using the parameters:
fmin= 2.3e+09, fmax= 2.5e+09, fstep= 833333
120001 lines read, deltat= 1.000000e-11 s, tau = 1.200000e-06 s

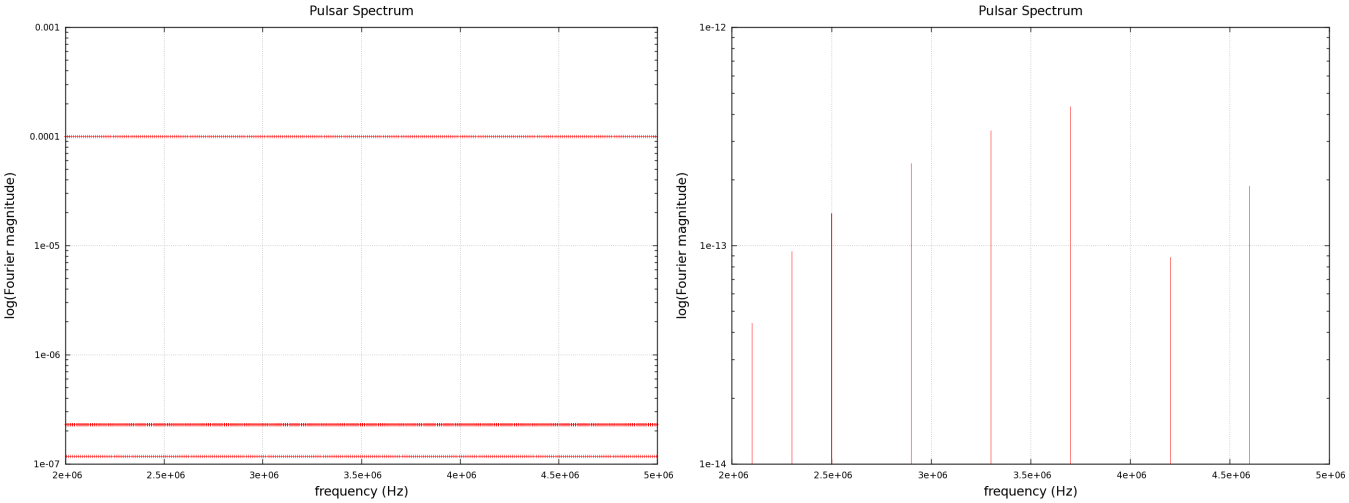

Figure 4: *Discrete fourier transform of Pulsar data*

The figure on the left was generated using the parameters:
fmin= 200000, fmax= 5e+06, fstep= 1000
100001 lines read, deltat= 1.000000e-04 s, tau = 1.000000e+01 s

The figure on the right was generated using the parameters:
fmin= 200000, fmax= 5e+06, fstep= 100000
100001 lines read, deltat= 1.000000e-04 s, tau = 1.000000e+01 s

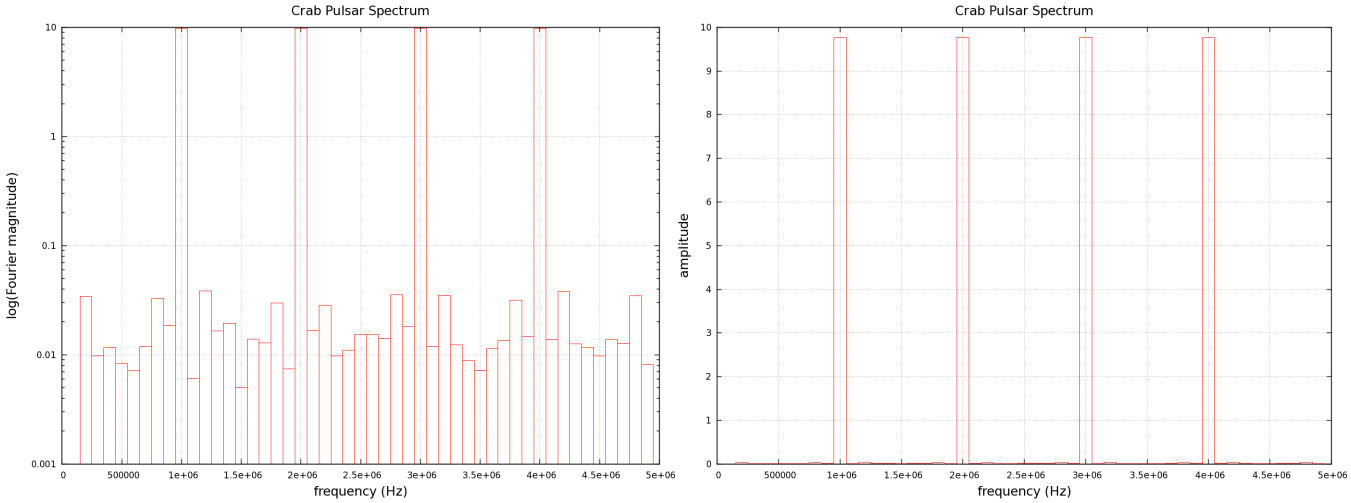

Figure 5: *Discrete fourier transform of Crab Pulsar data*

These figures were generated using the parameters:
fmin= 200000, fmax= 5e+06, fstep= 100000
148282 lines read, deltat= 6.734000e-05 s, tau = 9.985243e+00 s

This report can be seen in color at:
http://www2.hawaii.edu/~cmutnik/lab11.pdf