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Can someone provide me a Python program to calculate fundamental frequency and other frequencies of an unknown signal with 0.1 or 0.01 Hz accuracy?

Question

Asked March 10, 2017 in the project Numerical Relay

I'm using BeagleBone Black to detect frequencies present in an unknown signal (whose fundamental frequency can range from 45 Hz to 55 Hz). I've used the following Python program to obtain a value for fundamental frequency of the unknown signal.

import numpy as np

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All Answers (3)

Joerg Fricke added an answer March 13, 2017

Sorry, I can't help you with Python, but I think your problem lies on a more general level: If you apply FFT to a number of samples taken in the time interval T then the output represents the frequencies 0 f, 1 f, 2 f, ... with f = 1 / T. If you need a resolution of 0.1 Hz you have to feed into the FFT samples taken within 10 s; a resolution of 0.01 s would be based on samples taken in 100 s. If this are too much data to process in real time, the next question is: What is the maximum frequency you are interested in? With 16 kHz sampling frequency your upper limit would be 8 kHz.

If your signal has a spectrum containing virtually only *one* frequency with minor noise (as on the power lines, as long as there are no control signals added) then a much simpler algorithm would be (as used in frequency counters if the frequency is low):

Determine the time T between each second zero voltage crossing, and compute f = 1 / T. By computing the average value of several results you could eliminate noise.

To determine the presence of other frequencies above the line frequency, you could first send your samples through a (digital) high pass filter, and then decide if the amplitude is above a threshold value.

But if you really need a spectrum, and your hardware is too slow, I'm afraid you have to use a Digital Signal Processor.

I hope this helps.

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Fernando Soares Schlindwein added an answer

March 13, 2017

A few comments:

When you sample a signal x(t) to be x(nT) the sampled series is sometimes written as ... x(n) as a 'lazy notation' for x(nT). Similarly in frequency we have X(k/(NT)), and this is sometimes written as X(k) as the 'lazy notation'. The frequency resolution i

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U. Dreher added an answer

March 13, 2017

Joerg Fricke is absolutely correct rdgarding the necessity to process samples from 10 s resp. 100 s long intervals. In your special case a high sampling frequency might be counter-productive: if your interest is on the grid frequency, a comparably low sampling frequency might help to solve the problem (reduce the number of samples to process) - provided you've got an appropriate anti-aliasing filter. Otherwise aliasing eff

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Sandipan Dey

4.69 · University of Maryland, Baltimore County

Answer

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