Harmonic Analysis

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos(n\omega x) + \sum_{n=1}^{\infty} b_n \sin(n\omega x)$$

Where,

$$a_0 = \frac{2}{N} \Sigma\, y$$

$$a_n = \frac{2}{N} \Sigma\, y \cos(n\omega x)$$

$$b_n = \frac{2}{N} \Sigma\, y \sin(n\omega x)$$

$$\omega = \frac{2\pi}{T}$$

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function [hseries] = harmonic_analysis(x, y, k)

%% would work when x = [0 1 2 3 4  . . . ]
%% if angles are given then directly use them, since they are already partitioned

T = length(y);
omega = 2 * pi / T;
fprintf('Divided 2*pi into %d intervals of %.5f each\n', T, omega);

a0 = 2 .* mean(y);
syms t;

hseries = a0/2;

for n = 1 : k
    an(n) = 2 .* mean(y .* cos(n .* omega .* x));
    bn(n) = 2 .* mean(y .* sin(n .* omega .* x));
    hseries = hseries + an(n) .* cos(n * omega * t) + bn(n) .* sin(n * omega * t);
end

disp('Harmonic Series is : ')
disp(vpa(hseries, 10));

end
```