Harmonic distortion, even and odd functions.

Question 1: Why do memoryless functions only produce harmonic distortion for a single input frequency?

Any function can be approximated as a polynomial series expansion



Assume the input is a sinusoid

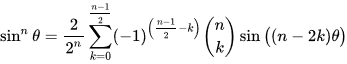


So



We can show that these reduce to terms involving 

But it gets really messy, really quick

*n* is odd: 

*n* is even: 

So do it with complex sinusoids.



which is only harmonics of the input (multiples of the input frequency).

Question 2: Do memoryless functions only produce harmonic distortion for inputs that are not a single frequency?





No!

Question 3: What distortion results when the input is an odd or an even function?

Odd function: 

Examples: 

Even function: 

Examples: 

Important property: Sum of odd functions is an odd function, sum of even functions is an even function, sum of odd and even functions is neither (unless one of the functions is 0)

Odd functions: 

Even functions: 

Odd and even functions: 

So 

So if f is odd, 

And if f is even, 

For a complex sinusoid, 

