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* Problem Statement: For a 1 ohm resistive load, design a periodic waveform with an average power of 1watt, that minimizes the power in the 5th harmonic with the restriction that the average value of the waveform is zero. Compare your result to the 5th harmonic power of a square wave with zero average voltage.
* Assumptions:
* ω= 2π/T=1
* T=2Π

Let v(t)=A\*cos(ω\*t)

∴ i(t)=(A/r=1Ω)\*cos(ω\*t)= A\*cos(ω\*t)

1=Pavg=(1/(2π))\*∫(0 to 2π)[ A2 cos2(t)]dt=A2/2

A2=2 A=√(2)≈ 1.4142

v(t)=√(2)\*cos(t)

* Because cos(t) is an even function, only it’s even harmonics have non-zero power. ∴ 5th harmonic power =0

For a square wave:

f(t)=0 if -π≤x<0 ; f(t)=1 if 0≤x<π & f(t+2π)=f(t)

a0=(1/(2π))\*∫(-π to π)[f(t)dt]=(1/(2π))\*∫(-π to 0)[0]dt+(1/(2π))\*∫(0 to π)[1]dt

a0=(1/(2\*π))\*π=1/2

for n≥1

an=(1/π)\*∫(-π to π)[f(t)\*cos(n\*t)]dt=(1/π)\*∫(-π to 0)[0]dt+(1/π)\*∫(0 to π)[1\*cos(n\*t)]dt=0

bn=(1/π)\*∫(0 to π)[1\*sin(n\*t)]dt = -(1/π)\*cos(n\*t)/n ⎢(0 to π)=-1/(n\*π)\*[cos(n\*π)-cos(0)]

∴ bn=0 , if n is even ; bn=2/(n\*π) ,if n is odd

f(x)=1/2+Σ(from n=1,3,5,… to ∞) [2/(n\*π)\*sin(n\*t)]

5th harmonic: 2/(5\*π)\*sin(5\*t)

Pavg=1/(2\*π)\*∫(from 0 to 2\*π) [4/(25\*π2)\*sin2(5t)]dt =1/(2\*π)\*4/(25\*π) =2/(25\*π2)>0=power in fifth harmonic of