1. Practice with Fourier series and ODEs

Find the smallest period

1/1 point (graded)

Find the Fourier series for $f(t) = |\sin(t)|$.

What is the **smallest** period for $f(t)$?

pi

π

FORMULA INPUT HELP

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Find the form of the Fourier series

1/1 point (graded)

Based on the period you found in the previous problem, the general form of the Fourier series of $f(t) = |\sin(t)|$ is

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

where $\omega_n =$ 2*n ✔

$2 \cdot n$

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Use symmetry

1/1 point (graded)

Which coefficients of the Fourier series for $f(t) = |\sin(t)|$ must be zero based on the symmetry of $f(t)$? (Check all that apply.)

- [ ] $a_0/2$
- [ ] $a_n, n \geq 1$
- [x] $b_n, n \geq 1$

✔

Submit

Find the Fourier coefficients

3/3 points (graded)

$a_0/2 =$ 2/pi

$\frac{2}{\pi}$

$a_n =$ (4/pi)*(1/(1-4*n^2))

$b_n =$ 0

0

FORMULA INPUT HELP

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Correct (3/3 points)

You can check your work on the problem above by instead computing the Fourier coefficients for the function as having period 2π rather than period π.

Pure resonance

3/3 points (graded)

For which values of ω does the system

$$10\ddot{x} + 100x = |\sin \omega t|$$

have pure resonance (unbounded solutions)?

Enter the three largest angular frequencies into the answer boxes below.

angular frequency 1 | 1.5811388 ✔

angular frequency 2 | 0.7905694 ✔

angular frequency 3 | 0.5270463 ✔

Submit You have used 3 of 5 attempts

✔ Correct (3/3 points)

1. Practice with Fourier series and ODEs

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Hints for the last question?

question posted about a month ago by xfabreguettes

Hi! I've got full marks on the whole page and can't get any mark on the last question. would it be possible to get some pointers? Am I right in working with omega (index n) = 2n as opposed to omega (index n) = n?

many thanks!

This post is visible to everyone.

elarX
about a month ago - marked as answer about a month ago by **jfrench** (Staff)

I spent way too long on this. As this is recitation, I'll point out that the driving term has a different period than the one we've calculated above.

Add a comment

Steve_Nicodemus (Community TA)
about a month ago - marked as answer about a month ago by **jfrench** (Staff)

This was a challenging one. I was about ready to give up for last night and try again this morning, but I tried submitting an answer and got it right.

After doing all of the calculations, the key for me was looking at one specific individual term of the Fourier series for each frequency. (I mean a different term for each frequency.)

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jfrench (Staff)
about a month ago

You actually did have one answer that was close, but each frequency was missing a scaling factor. Your approach is the right one.

That's the key!!! this was a nice exercise

posted 28 days ago by XaviHaz

Add a comment

wcyi56
30 days ago

Attention that the input is $|sin\,(\omega t)\,|$, not $|sin\,(t)\,|$.

Add a comment

davidstuartbruce
19 days ago

I almost gave up on this. Seeing as how this is a recitation, and we are free to discuss everything up to a full solution, the key concept here is that ω could possibly "blow up" either the ERF or some of the a_n or b_n. So if you do some difficult computations and find that ω appears to drop out, you need to look for values that cause a different denominator to go to zero.

David

Add a comment

agiri123
18 days ago

I am afraid all the comments above were a bit too mysterious for me. Here is how i solved it. Hopefully this helps someone else too:

Look at Unit 1 -> 3. Solving ODEs with Fourier Series and Signal Processing -> 7. Same example, but with period 2L

This gives the form of solution for equations of type $y'' + \omega_0^2 y = f(t)$.

Remember the following:

1) $f(t)$ is $|sin(\omega t)|$. So use the solutions from earlier parts for $|sin(t)|$ but do not forget to scale ω_n appropriately.

2) You will see that the terms of the solution $x_p(t)$ depend on both ω_n and ω_0. Note that ω_0 is a constant based on the problem statement.

3) Compute values of ω_n that cause resonance.

...

My problem was that I expected integers in the answer.

posted 17 days ago by **anton_melnikov**

...

I am still struggling at this last moment. My understanding was that omega_n was function of n and omega. (2*n*omega). As n is integer and omega is just any real number, we can find infinite combinations of n and omega which makes omega_n = omega_0 and create resonance. How we can find top three?

posted 15 days ago by **SumiArima**

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