

3. Solving ODEs with Fourier Series

<u>Course</u> > <u>Unit 1: Fourier Series</u> > <u>and Signal Processing</u>

> 4. System response

4. System response

Now let's return to the original problem. Suppose that the input signal f is an odd periodic function of period 2π . Since f is odd, the Fourier series of f is a linear combination of sine functions

$$f(t) = b_1 \sin t + b_2 \sin 2t + b_3 \sin 3t + \cdots$$

Let f(t) be the input of the system

$$\ddot{x} + 50x = f(t).$$

By the superposition principle, the system response to $f\left(t
ight)$ is

$$x\left(t
ight) = {b_1}rac{1}{{49}}\sin t + {b_2}rac{1}{{46}}\sin 2t + {b_3}rac{1}{{41}}\sin 3t + \cdots.$$

Note that each Fourier component $\sin nt$ has a different gain: the gain depends on the frequency.

One could write a particular solution using sigma-notation:

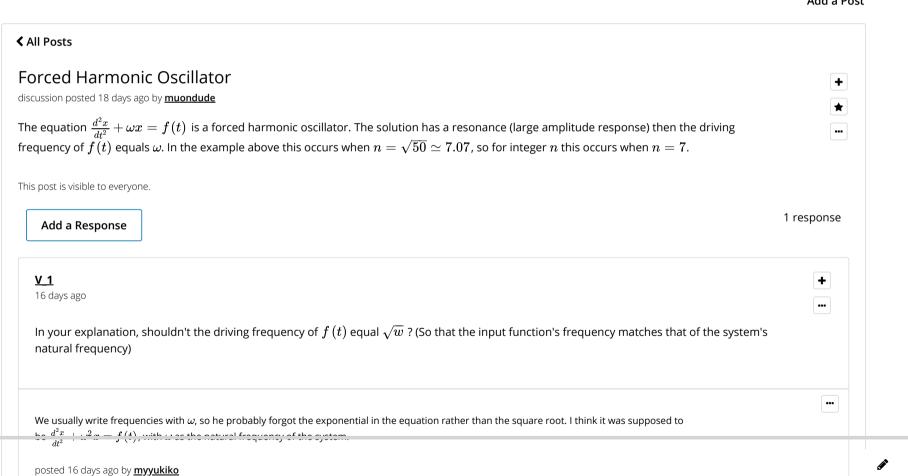
$$\left| x_p \left(t
ight) = \sum_{n \geq 1} rac{1}{50 - n^2} b_n \sin nt.
ight|$$

4. System response

Hide Discussion

Topic: Unit 1: Fourier Series / 4. System response

Add a Post



Showing all responses			
Add a response:			
Preview			

© All Rights Reserved