

Problem 1.26 Determine the period of each of the following waveforms:

(a) $x_1(t) = \sin 2t$

(b) $x_2(t) = \cos\left(\frac{\pi}{3}t\right)$

(c) $x_3(t) = \cos^2\left(\frac{\pi}{3}t\right)$

(d) $x_4(t) = \cos(4\pi t + 60^\circ) - \sin(4\pi t + 60^\circ)$

(e) $x_5(t) = \cos\left(\frac{4}{\pi}t + 30^\circ\right) - \sin(4\pi t + 30^\circ)$

Solution: The period of $A \cos(\omega t + \theta)$ is $\frac{2\pi}{\omega}$ if $\omega \neq 0$.

(a) The period is $\frac{2\pi}{2} = \boxed{\pi}$.

(b) The period is $\frac{2\pi}{\pi/3} = \boxed{6}$.

(c) $\cos^2\left(\frac{\pi}{3}t\right) = \frac{1}{2} + \frac{1}{2}\cos\left(2\frac{\pi}{3}t\right)$. The period is $\frac{2\pi}{2\pi/3} = \boxed{3}$.

(d) $\cos(4\pi t + 60^\circ) - \sin(4\pi t + 60^\circ) = \sqrt{2}\cos(4\pi t + 105^\circ)$. The period is

$$\frac{2\pi}{4\pi} = \boxed{\frac{1}{2}}.$$

(e) The period of $\cos\left(\frac{4}{\pi}t + 30^\circ\right)$ is $\frac{2\pi}{4/\pi} = \frac{\pi^2}{2}$. This repeats every

$$\left\{\frac{\pi^2}{2}, 2\frac{\pi^2}{2}, 3\frac{\pi^2}{2}, \dots\right\}.$$

The period of $-\sin(4\pi t + 30^\circ)$ is $\frac{2\pi}{4\pi} = \frac{1}{2}$. This repeats every $\{\frac{1}{2}, 2(\frac{1}{2}), 3(\frac{1}{2}), \dots\}$.

So the sum of these two sinusoids is not periodic.

Engineering Signals And Systems Solution Manual

Laurie Kelly, Northrop/Robert B.



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Analog and Digital Signals and Systems R. K. Rao Yarlagaadda, 2010-08-05 This book presents a systematic comprehensive treatment of analog and discrete signal analysis and synthesis and an introduction to analog communication theory This evolved from my 40 years of teaching at Oklahoma State University OSU It is based on three courses Signal Analysis a second semester junior level course Active Filters a first semester senior level course and Digital signal processing a second semester senior level course I have taught these courses a number of times using this material along with existing texts The references for the books and journals over 160 references are listed in the bibliography section At the undergraduate level most signal analysis courses do not require probability theory Only a very small portion of this topic is included here I emphasized the basics in the book with simple mathematics and the sophistication is minimal Theorem proof type of material is not emphasized The book uses the following model 1 Learn basics 2 Check the work using benchmarks 3 Use software to see if the results are accurate The book provides detailed examples over 400 with applications A three number system is used consisting of chapter number section number example or problem number thus allowing the student to quickly identify the related material in the appropriate section of the book The book includes well over 400 homework problems Problem numbers are identified using the above three number system

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 $\text{hcl aq} + \text{naoh aq} \rightarrow \text{nacl aq} + \text{h}_2\text{o l}$ hcl a q naoh a q nacl a q h 2 o l one mole of hcl hcl would be fully neutralized by one mole of naoh naoh

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