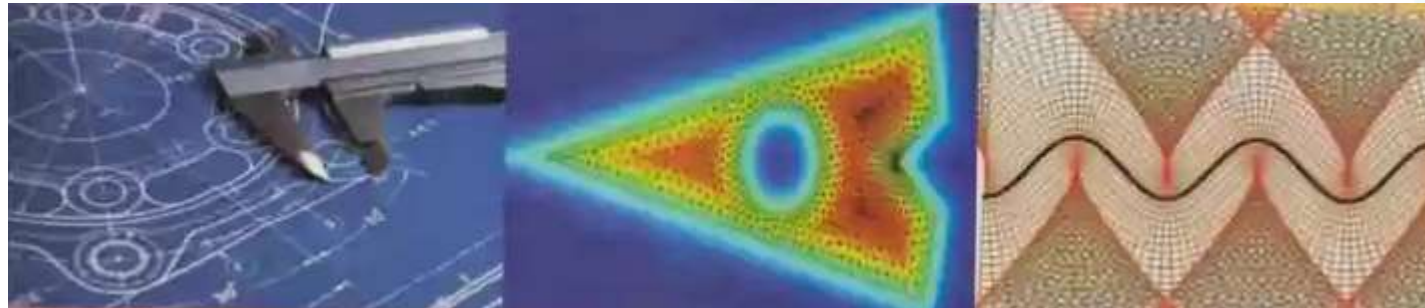


CEDC301: Mathematics Engineering

Exercises: Fourier Analysis: Part B



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1. Expand the given function in an appropriate cosine or sine series

$$f(x) = |x|, \quad -\pi < x < \pi$$

$$f(x) = \pi^2 - x^2, \quad -\pi < x < \pi$$

$$f(x) = \cos x, \quad -\pi/2 < x < \pi/2$$

$$f(x) = \begin{cases} x - 1, & -\pi < x < 0 \\ x + 1, & 0 \leq x < \pi \end{cases}$$

2. Find the half-range cosine and sine expansions of the given function

$$f(x) = \cos x, \quad 0 < x < \pi/2$$

$$f(x) = \sin x, \quad 0 < x < \pi$$

$$f(x) = \begin{cases} x, & 0 < x < \pi/2 \\ \pi - x, & \pi/2 \leq x < \pi \end{cases}$$

3. Apply the Parseval relation to the Fourier series of $f(x) = |x|$, defined over the interval $-\pi < x < \pi$, to prove

$$\frac{\pi^4}{96} = 1 + \frac{1}{3^4} + \frac{1}{5^4} + \frac{1}{7^4} + \dots$$

4. Find the complex Fourier series of f on the given interval

$$f(x) = \begin{cases} -1, & -2 < x < 0 \\ 1, & 0 < x < 2 \end{cases}$$

Find the frequency spectrum of the periodic wave that is the periodic extension of the function f

4. Find the complex Fourier series of f on the given interval

$$f(x) = \begin{cases} 0, & -\frac{1}{2} < x < 0 \\ 1, & 0 < x < \frac{1}{4} \\ 0, & \frac{1}{4} < x < \frac{1}{2} \end{cases}$$

Find the frequency spectrum of the periodic wave that is the periodic extension of the function f