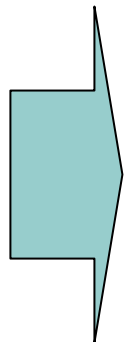


DERET FOURIER $T = 2L$

- Fungsi dengan periode $T = 2L$ ($T = 2\pi / \omega$, $L = \pi / \omega$)

$$f(x) = a_0 + \sum_{n=1}^{\infty} \left(a_n \cos \frac{n\pi x}{L} + b_n \sin \frac{n\pi x}{L} \right)$$

Koefisien
deret
Fourier :



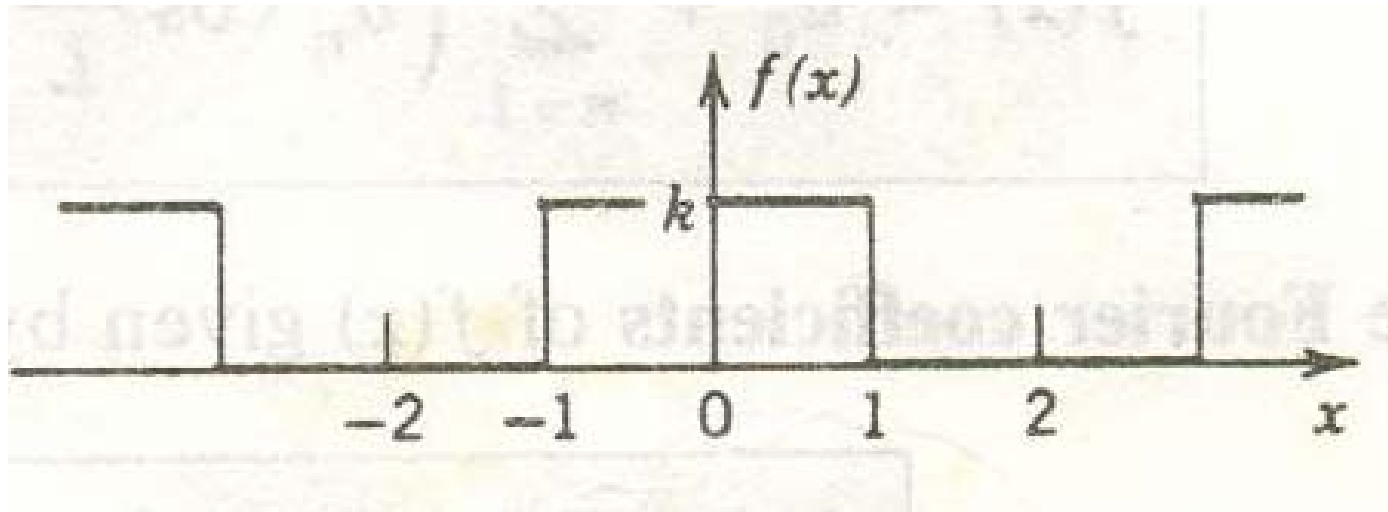
$$a_0 = \frac{1}{2L} \int_{-L}^L f(x) dx$$

$$a_n = \frac{1}{L} \int_{-L}^L f(x) \cos \frac{n\pi x}{L} dx \quad n = 1, 2, \dots$$

$$b_n = \frac{1}{L} \int_{-L}^L f(x) \sin \frac{n\pi x}{L} dx \quad n = 1, 2, \dots$$

Contoh :

$$f(x) = \begin{cases} 0 & \text{jika } -2 < x < -1 \\ k & \text{jika } -1 < x < 1 \\ 0 & \text{jika } 1 < x < 2 \end{cases} \quad T = 2L = 4, \quad L = 2$$



Penyelesaian :

$$a_0 = \frac{1}{4} \int_{-2}^2 f(x) dx = \frac{1}{4} \left[\int_{-1}^1 k dx \right] = \frac{1}{4} \left[kx \Big|_{-1}^1 \right] = \frac{k}{2}$$

$$\begin{aligned} a_n &= \frac{1}{2} \int_{-2}^2 f(x) \cos \frac{n\pi x}{2} dx = \frac{1}{2} \left[\int_{-1}^1 k \cos \frac{n\pi x}{2} dx \right] \\ &= \frac{1}{2} \left[\frac{k}{n} \sin \frac{n\pi x}{2} \Big|_{-1}^1 \right] = \frac{2k}{n\pi} \sin \frac{n\pi}{2} \end{aligned}$$

$a_n = 0$, jika n genap

$$a_n = \frac{2k}{n\pi}, \text{ jika } n = 1, 5, 9, \dots \quad a_n = -\frac{2k}{n\pi}, \text{ jika } n = 3, 7, 11, \dots$$

Penyelesaian :

$$\begin{aligned} b_n &= \frac{1}{2} \int_{-2}^2 f(x) \sin \frac{n\pi x}{2} dx = \frac{1}{2} \left[\int_{-1}^1 k \sin \frac{n\pi x}{2} dx \right] \\ &= \frac{1}{2} \left[\frac{k}{n} \cos \frac{n\pi x}{2} \Big|_{-1}^1 \right] = 0, \text{ untuk } n = 1, 2, 3, \dots \end{aligned}$$

$$f(x) = a_0 + \sum_{n=1}^{\infty} a_n \cos \frac{n\pi}{2} x$$

$$f(x) = \frac{k}{2} + \frac{2k}{\pi} \left(\cos \frac{\pi}{2} x - \frac{1}{3} \cos \frac{3\pi}{2} x + \frac{1}{5} \cos \frac{5\pi}{2} x - + \dots \right)$$

Fungsi Genap dan Fungsi Ganjil

Fungsi $g(x)$ adalah fungsi genap jika

$$g(-x) = g(x)$$

Contoh : $\cos x$, x^2

Fungsi $h(x)$ adalah fungsi ganjil jika

$$h(-x) = -h(x)$$

Contoh : $\sin x$, x^3

(Genap) x (Genap) = Genap

(Ganjil) x (Ganjil) = Genap

(Genap) x (Ganjil) = Ganjil

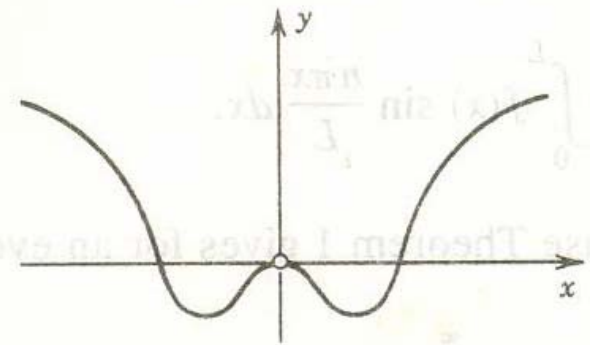


Fig. 235. Even function

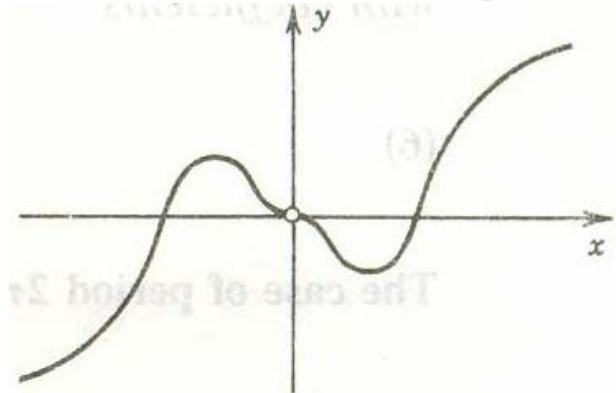


Fig. 236. Odd function

Deret Fourier dari Fungsi Genap dan Fungsi Ganjil

- **Deret Cosinus Fourier** (Deret Fourier dari fungsi genap dengan periode $T = 2L$)

$$f(x) = a_0 + \sum_{n=1}^{\infty} a_n \cos \frac{n\pi}{L} x$$

Koefisien deret Fourier :

$$a_0 = \frac{1}{L} \int_0^L f(x) dx$$

$$a_n = \frac{2}{L} \int_0^L f(x) \cos \frac{n\pi x}{L} dx \quad n = 1, 2, \dots$$



Deret Fourier dari Fungsi Genap dan Fungsi Ganjil

- **Deret Sinus Fourier** (Deret Fourier dari fungsi ganjil dengan periode $T = 2L$)

$$f(x) = \sum_{n=1}^{\infty} b_n \sin \frac{n\pi}{L} x$$

Koefisien derer Fourier :

$$b_n = \frac{2}{L} \int_0^L f(x) \sin \frac{n\pi x}{L} dx \quad n = 1, 2, \dots$$