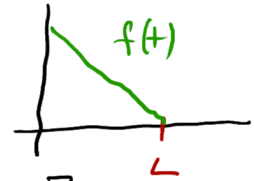# Fourier cosine + sine series

situation   function $f(t)$ defined on $[0, L]$
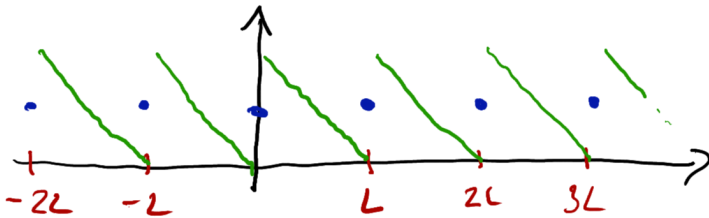
options (depending on application)

$f(t)$

- extend $f(t)$ to be L-periodic

$$f(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} \left[a_n \cos\left(\frac{2\pi n t}{L}\right) + b_n \sin\left(\frac{2\pi n t}{L}\right) \right]$$
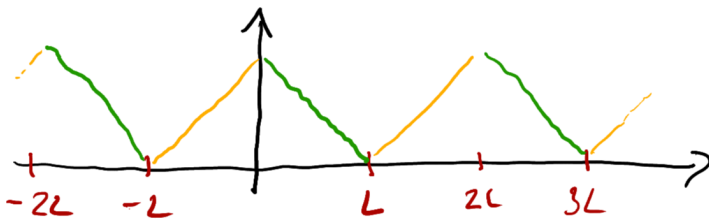
Fourier series of $f(t)$

$-2L \quad -L \quad\quad L \quad 2L \quad 3L$

- extend $f(t)$ to be even and $2L$-periodic

$$f(t) = \frac{\tilde{a}_0}{2} + \sum_{n=1}^{\infty} \tilde{a}_n \cos\left(\frac{\pi n t}{L}\right)$$

Fourier cosine series of $f(t)$

$-2L \quad -L \quad\quad L \quad 2L \quad 3L$

- extend $f(t)$ to be odd and $2L$-periodic

$$f(t) = \sum_{n=1}^{\infty} \tilde{b}_n \sin\left(\frac{\pi n t}{L}\right)$$

Fourier sine series of $f(t)$

$-2L \quad -L \quad\quad L \quad 2L \quad 3L$