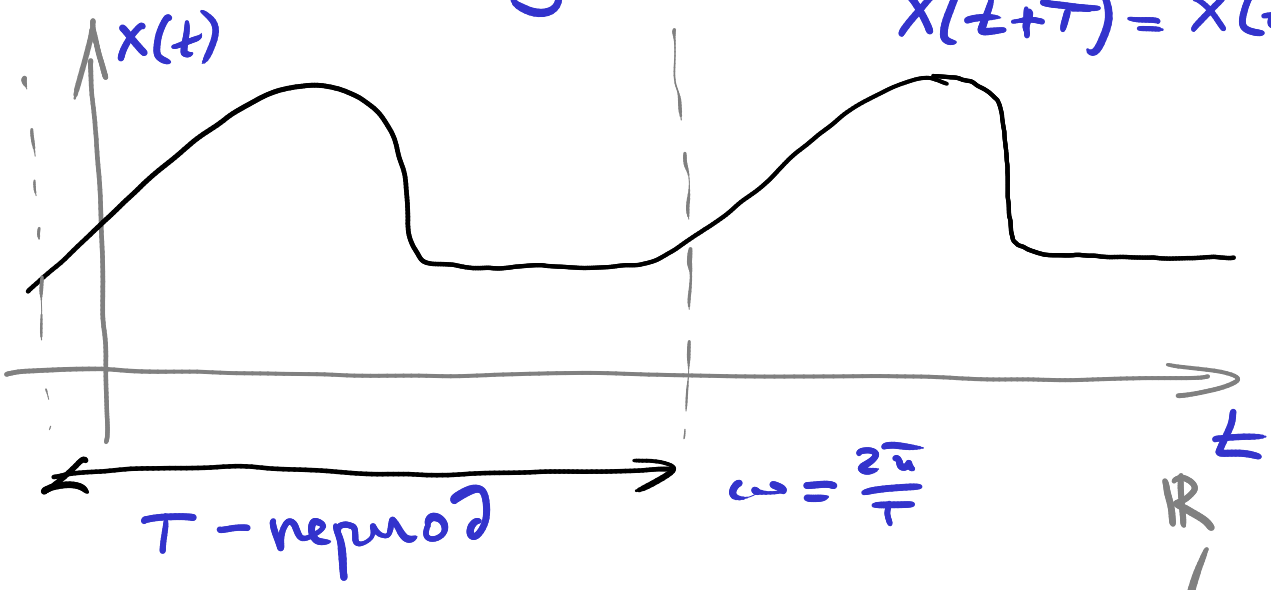
Ряд Фурье.



$x(t+T) = x(t)$

$\omega = \frac{2\pi}{T}$

$\mathbb{R}$

$$x(t) = \frac{a_0}{2} + a_1 \cos\omega t + b_1 \sin\omega t + a_2 \cos 2\omega t + b_2 \sin 2\omega t + (\dots) =$$

$$= \dots + c_{-1} \cdot e^{-i\omega t} + c_0 + c_1 \cdot e^{i\omega t} + c_2 e^{2i\omega t} + \dots$$

ортогональны

$\mathbb{C}$

$$\underbrace{\int_0^T f(t) g(t)^* \, dt}_{(f,g)} = 0, \quad \|f\| = \sqrt{(f,f)}$$

$$\int \left(\frac{a_0}{2} + a_1 \cos\omega t + b_1 \sin\omega t - x(t)\right)^2 dt \approx \min$$

$$\sum_{t_i} \underbrace{\left(\frac{a_0}{2} + a_1 \cos\omega t_i + b_1 \sin\omega t_i - x_i\right)^2}_{!} \to \min$$

$$(Ac - x)^T (Ac - x) \to \min$$

$$\underline{c = (A^T A)^{-1} A^T x}$$

$$\xrightarrow{3} \quad N \downarrow \quad \begin{pmatrix} 1 & \cos\omega t_1 & \sin\omega t_1 \\ 1 & \cos\omega t_2 & \sin\omega t_2 \\ \vdots & \vdots & \vdots \\ 1 & \cos\omega t_N & \sin\omega t_N \end{pmatrix} \begin{pmatrix} a_0/2 \\ a_1 \\ b_1 \end{pmatrix} = \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_N \end{pmatrix}$$

$Ac = x$

?