



MMP II

Tutorial 1

HS 2017
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Exercise 1: Fourier series (5 Pts.)

Let g be the periodic extension of f defined as

$$f(x) = \begin{cases} x^2 & \text{if } x \in (-\pi, \pi) \\ 0 & \text{if } x = \pi \end{cases} \quad (1.1)$$

a) Calculate the coefficients of its Fourier series

$$S_g = \frac{a_0}{2} + \sum_{n=1}^{\infty} (a_n \cos nx + b_n \sin nx) . \quad (1.2)$$

Find S_g .

b) Study the convergence properties of the series.

Exercise 2: Series expansion (4 Pts.)

Show that for $-\pi < x < \pi$ the following equation is valid

$$x = 2 \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} \sin nx . \quad (2.1)$$

Using the above result, derive the following

$$1 - \frac{1}{3} + \frac{1}{5} - \dots = \frac{\pi}{4} . \quad (2.2)$$

Exercise 3: Fourier series II (5 Pts.)

Let $g : \mathbb{R} \rightarrow \mathbb{R}$ be the function obtained through the periodic extension of

$$f : (-\pi, \pi] \rightarrow \mathbb{R} \quad \text{with} \quad f(x) = \begin{cases} x \cos x & -\pi < x < \pi \\ 0 & x = \pi . \end{cases} \quad (3.1)$$

a) Determine the Fourier coefficients of g .

b) Study the convergence properties of the series.