Fourier Cosine Series

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A Maple notebook to compute the first few terms of the Fourier cosine expansion of a function f(x) defined on an interval $0 \le x \le L$.

> restart;

Define interval and function

> L := 2; $f(x) := x - \frac{x^2}{3}$

Choose number n of Fourier cosine coefficients to compute and set up array "a[k]" to hold coefficients > n := 5;

$$a \coloneqq array(0..n)$$

Compute coefficients, either symbolically or numerically

> for k from 0 to n do

$$a[k] := \frac{2}{L} \cdot int \left(f(x) \cdot \cos\left(\frac{k \cdot \operatorname{Pi} \cdot x}{L}\right), x = 0 \dots L \right) : #for symbolic computation$$
$$#a[k] := evalf \left(\frac{2}{L} \cdot Int \left(f(x) \cdot \cos\left(\frac{k \cdot \operatorname{Pi} \cdot x}{L}\right), x = 0 \dots L \right) \right) : #for numeric computation$$

od:

>

Form the Fourier cosine approximation

> fourier_cosapp :=
$$\frac{a[0]}{2} + add \left(a[k] \cdot \cos\left(\frac{k \cdot \operatorname{Pi} \cdot x}{L}\right), k = 1..n\right)$$

Plot and compare to f(x)