SCHOOL OF MATHEMATICS AND PHYSICS

Approximation theory

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1. Expand the following functions in an appropriate cosine or sine series.

1. $f(x) = \begin{cases} -1, & -\pi < x < 0 \\ 1, & 0 \le x < \pi. \end{cases}$

2. $f(x) = \begin{cases} x - 1, & -\pi < x < 0 \\ x + 1, & 0 \le x < \pi. \end{cases}$

3. $f(x) = \begin{cases} x + 1, & -\pi < x < 0 \\ x - 1, & 0 \le x < \pi. \end{cases}$

4. $f(x) = |x|, -\pi < x < \pi.$

5. $f(x) = x^2, -\pi < x < \pi.$

2. Find the Legendre and Chebysheb polynomial approximation on the interval $[-1, 1]$ for the following functions.

1. $f(x) = x^2 - 2x + 3$

2. x^3

3. $\frac{1}{x+2}$

4. e^x

5. $\ln(x + 2)$

Use the simulation from the SciMS website to visualise the partial sums of the approximations and to check your results. Click on the link below or type the URL into your browser's address bar.

https://teaching.smp.uq.edu.au/scims/Num_analysis/Polynomial.html