# Numerical Methods in Engineering and Applied Science. Assignment 2.

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1. Is (1) a consistent approximation to the first derivative of u(x)?

Yes. Answer why in the next point.

1. Use the Taylor series expansion to find the order of this approximation.

Let’s consider coefficients at .

Coefficient at is zero.

Performing this procedure for other members in the Tailor series:

Therefore:

3rd order of approximation.

While is small then it is a consistent approximation.

Homogenous:

Particular solution of the equation.

Let

get:

Summing up:

Periodic boundary conditions:

Summing up:

1. Use the finite-difference approximation (1) to solve this problem numerically. Plot the exact and the approximate u(x) calculated on a uniform grid with step h = π/10 over the interval from 0 to 2π.

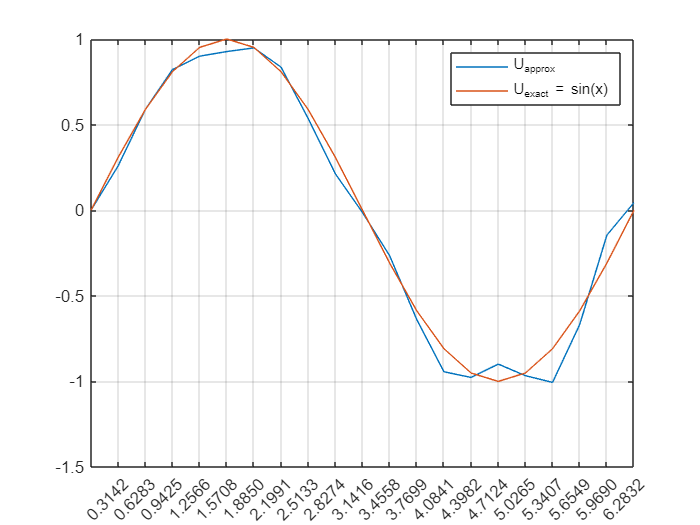
Represent as:

From the task:

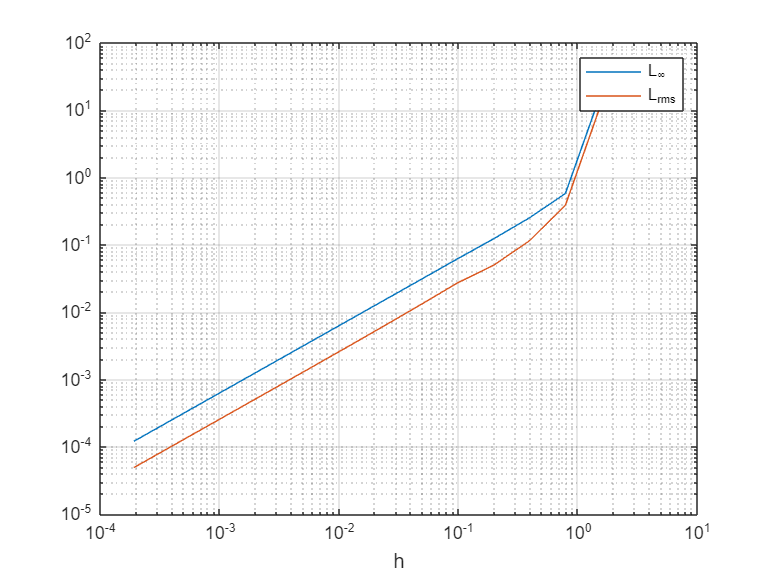
Keep in mind that and neglect every .

Solve

Plot the exact and the approximate u(x) calculated on a uniform grid with step h = π/10 over the interval from 0 to 2π.



1. Vary h from a suitably small to a suitably large value to plot the convergence error norms (pointwise maximum and r.m.s.) as functions of h. Comment on the rate of convergence: compare your numerical observation with your theoretical result.



It is clear that So if we divide by 2, becomes twice smaller.

The numerical result gives the same as theoretical.