دانشکده مهندسی برق
گروه کنترل

بنام آنکه جان را فکرت آموخت

روشهای محاسبات عددی

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1.a.Use the Lagrange Method to find cubic interpolating polynomial $P_3(x)$ for the following data.

b. Also use the Rational Method to find rational function interpolating for the following data.

x	1	2	4	6
y	-1	-1	2	1

2. The following data show estimates of the population of the Liberia in selected years between 1960 and 2010.

Year	1960	1970	1980	1990	2000	2010
Population (millions)	1.1	1.4	1.9	2.1	2.8	4

(a) Calculate the rate of growth of the population in millions per year for 2010. Use the formula : $y'_i = \frac{y_i - y_{i-1}}{h}$

What is the order of the derivative error?

(b) Calculate the rate of growth of the population in millions per year for 2010. Use the following formula :

$$y'_i = \frac{3y_i - 4y_{i-1} + y_{i-2}}{2h}$$

What is the order of the derivative error?

(c) Using the slope in 2010 from part (b) , apply the two-point central difference formula for drivative to extrapolate and predict the population in the year 2020.

(d) Using the forward Newton interpolating to predict the population in the year 2020.

3. Consider the following system of two ODEs :

$\frac{dx}{dt} = x - yt$, $\frac{dy}{dt} = t + y$ from t=0 to t=1.2 with x(0)=1, and y(0)=1

(a) Solve with the second-order Range-Kutta method (piraste oiler) using h=0.4 .

(b) Solve with the classical fourth-order Range-Kutta method using h=0.4 .

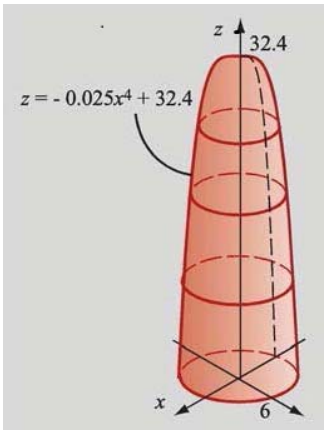
The analytical solution of the system is $x(t) = 4e^t - t^2e^t - t^2 - 3t - 3$, $y(t) = 2e^t - t - 1$. In each part, calculate the error between the true solution and the numerical solution at the points where the numerical solution is determined.

4. Consider the ODE : $y' = \frac{x^2}{y^2 - 1}$, $y(0) = 0$

Solve ODE with the picard method for 2 stages.

If solution precision be 3-digits, what is quantity of x?

5. A silo structure is made by revolving the curve $z = -0.025x^4 + 32.4$ from x=0 m to x=6 m about the z-axis , as shown in the figure to the right.



The surface area,S, that is obtained by revolving a curve z=f(x) in the domain from a to b around the z-axis can be calculated by :

$$S = 2\pi \int_a^b x\sqrt{1 + [f'(x)]^2}\,dx$$

a. Calculate S with 2-digit precision using the composite trapezoidal method and modified composite trapezoidal method.

b. Calculate S with 2-digit precision using the romberg method.
c. Calculate S with 2-digit precision using the middle point method.
d. Calculate S with 2-digit precision using the Gauss-Legendre method with 2 & 3 Points and calculate maximum error .

6. Write a C program for Milne Method and use following Example :

$$y' = \frac{x^2}{y^2 - 1} \ , \ y(0) = 0 \ , \ 0 \le x \le 1 \ , \ h = 0.1$$

To determine reminder initial condition in above method, use the second-order Range-Kutta method (piraste oiler) .

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