Numally ODE(Numerical and Analytical Method for solving ODE)

Idea

Systematic Approach to solve any given ode of nth degree and nth order utilizing both Numerical and Analytical Methods, that may include both the classes whether the given differential equation may be a Homogeneous or Heterogeneous equation.

The general equation which to be considered is

$$X^n = A_1x^n + A_2x^{n-1} + A_3x^{n-2} \ldots + A_n$$

Where the equation constants $A_1,A_2,A_3,.....,A_n$, for any given Homogeneous or Heterogeneous differential equation any verifying the solution in both analytical and numerical methods.

The numerical methods includes:

1.**RUNGE-KUTTA METHOD**

Let an initial value problem be specified as follows: $y(t0)=y0$.
And utilising the following equations we can solve the given differential equation.

$$y_{n+1}=y_{n+1}+ 1/6(k_1+2k_2+2k_3+k_4) \qquad and \;\; t_{n+1} = t_n + h$$

2. MODIFIED EULER'S METHOD

A simple modification of the Euler method which eliminates the stability problems noted in the previous section is the backward Euler method:

$$y_{n+1}=y_n + hf(tn+1,y_{n+1}).y_{n+1} = y_n + hf(t_{n+1} , y_{n+1}).$$

3. MILNE'S METHOD

In numerical analysis, predictor–corrector methods belong to a class of algorithms designed to integrate ordinary differential equations – to find an unknown function that satisfies a given differential equation. All such algorithms proceed in two steps:

$$Y_{i+1} = y_i + hf(t_i, y_i), \quad \text{and} \quad Y_{i+1} = y_i + 1/2h(f(t_i, y_i) + f(t_{i+1}, y_{i+!}))$$

4. ADAMS-BASHFORTH METHOD

The Adams–Bashforth methods are explicit methods. Of which the consecutive $y_{n+1,}$, y_{n+2}, y_{n+3}, y_{n+4}, y_{n+5} and hence evluating for y and hence f(t).

The Adams–Bashforth methods were designed by John Couch Adams to solve a differential equation modelling capillary action due to Francis Bashforth. Bashforth (1883) published his theory and Adams' numerical method (Goldstine 1977).

The Analytical Solution is found by numerous methods which may include

1. Limit of Sum method.

2. Specific equation using Fourier Transformation.

3. Specific equation using Laplace equation.

Link to my github page to follow up all the methods so specified with complete details to it

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Bios

Arbhasun Banerjee from Bangalore,Karnataka State India Studying at Govt. SKSJTI 4th Semester Computer Science Engineering Graduate with 2 years of heavy exposures to both Hardware and Software interface and Knowledge of Either of the Scripting Languages Python and Javascript.
And emerged Victorious in many National Level Competitions arranged at prestigious Government Institutions like IISC, Bangalore, NIE,Mysore, TCS informatica data analysis presentation and BHU, Benaras,UP for SIH 2020.

Jagruthi 2019 & Jagruthi 2020 at IISC,Bangalore
Symbiot 2020 at VVCE,Mysore

Status

Currently the available system adopts various time consuming algorithms providing greater latency.

Most of the above mentioned methods are efficient and precise yielding expected answers and mostly these methods are not implemented in a large scale though having a vast area of exploration for the Sympy Community.

Involved Software:

1. Python libraries or Javascript for computing.

2. Django for web interface.

3. Graphql or equivalent Libraries for plotting and representation.

4. Git for Documentations.

Difficulty:

Medium as having a vast exposures for the above mentioned Softwares. With proper Guidance and Mentorship the above mentioned Idea can be implemented in ease.

Prerequisite Knowledge:

1. Differential equations

2. Python libraries or Javascript for computing.

3. Django for web interface.

4. Graphql or equivalent Libraries for plotting and representation.

5. Git for Documentations.

6. Shell scriptting for basic linux systems.

Potential mentor:

Oscar Benjamin