Numerical Solution Of The Duffing'S Equation Based On Ode 45 Solver

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Abstract: The Duffing's equation arises in the motion of a simple pendulum. A few numerical values is presented for the numerical solution of the differential equation based on the ODE 45 solver, fundamentally 4th order Runge-Kutta based. The 4th order Runge-Kutta method has been applied in diverse applications in physical and mathematical sciences, etc and different modifications like the Adam-Bashforth, Milne's predictor-corrector methods, etc have emerged for enhanced performance.
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Key words: Numerical Solution, Duffing'S Equation, Ode 45 Solver.

Introduction

Differential equation arises in diverse number of systems and application in dynamical systems, etc. Precisely, the numerical solution of the Duffing's equation is considered based on the ODE 45 solver, and subject to a requisite initial condition.

Discussion

The Duffing's equation arises out of the motion of a pendulum, it is expressed as;

$$\breve{\phi} + a\sin\phi = cost, \phi(0) = \phi(\pi) = 0.$$

The differential equation has an integral equivalent or equation representation viz;

$$\phi(t) - \int_0^t (t-y)\left\{a(\phi(y)) - \frac{1}{6}\phi^3(y)\right\}dy = ct$$

,where c is the unknown value of $\phi'(0)$which is called the shape parameter.

Result

'' Numerical solution based on ODE 45 Numerical Solver''

y=	ϕ=
0	1.0000
0.0250	0.9980
0.0125	0.9960
0.0375	0.9940
0.0500	0.9920
0.0625	0.9900
0.0750	0.9879
0.0875	0.9859
0.1000	0.9839
0.1125	0.9818
0.1250	0.9798
0.1375	0.9758
0.1500	0.9738
0.1625	0.9718
0.1750	0.9698
0.1875	0.9679
0.2000	0.9659

Conclusion

The numerical solution for a few values based on the ODE solver, fundamentally 4th order Runge-Kutta based has been presented.

References

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