# A THREE-STEP NUMERICAL APPROXIMANT BASED ON BLOCK HYBRID BACKWARD DIFFERENTIATION FORMULA FOR STIFF SYSTEM OF ORDINARY DIFFERENTIAL EQUATIONS

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Mathematical modelling involving stiff systems [1] is widely applicable in the field of science, engineering and technology [2]. Most of these models come as ordinary differential equations (ODEs) or system of ODEs that scientists, engineers and technologists must solve. However, many of these models defy analytic approaches in their solution. As a result, research into numerical approach to solving problems of stiff systems is a worthwhile undertaking.

In this paper, we present a three-step numerical approximant based on block hybrid backward differentiation formula (BDF) [1, 3] for the solution of stiff systems of ODEs. The ordinary differential equation has been formulated through continuous collocation approach using Legendre polynomial as basis function. Three off-grid points were incorporated at interpolation in order to retain the single function evaluation characteristic, which is peculiar to BDF. The basic properties of numerical methods were analyzed and the method was found to be consistent with a uniform order six and error constants

$$C=\left(-\frac{159}{448}\quad -\frac{81}{224}\quad -\frac{501}{896}\quad -\frac{177}{224}\quad -\frac{1035}{448}\quad -\frac{15}{224}\right)^{T},$$

zero-stable and as such, convergent.

The region of absolute stability of the method was analyzed using the general linear method, plotted and found to be stable over a large region. The method computes the solution of stiff of systems ODEs in a block by block way by some discrete schemes obtained from the associated continuous scheme which are combined and implemented as a set of block formulae which is able to produce approximationsyn+1, yn+2,yn+3for givenyn.

Numerical experiments were carried out and the results obtained, in comparison with the exact or analytical solutions and some methods found in literatures, show that the methods are efficient and accurate.

## REFERENCES

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