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**Title of Manuscripts for Menemui Matematik**

**First Author1 and Second Author2\***

1*Department of Mathematics, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor*

2*Department of Mathematics, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM Skudai,*

1email1@upm.edu.my, 2email2@mel.fs.utm.my

\*Corresponding author

*Received:*

*Accepted:*

**ABSTRACT**

This template represents the basic guidelines and desired layout final manuscript of Menemui Matematik. Abstract should not contain any equations, references, or footnotes. This article plays the role of a template as well as the guidelines for prospective authors who will have to prepare the final manuscript accepted for publication by Menemui Matematik.

**Keywords: Keywords1, Keywords2, Keywords3**

**INTRODUCTION**

One-step Runge-Kutta method which is a self-starting numerical method gains tremendous popularity for the computations of numerical solutions of first order initial value problems given by

, (1)

According to Alexander (1977) and Alexander (2003), the rationale behind the Runge-Kutta method is to approximate the integral in

 (2)

by a qudrature formula as follows:

 (3)

where the numbers and which are independent of the function *f*, are called the quadrature weights and nodes respectively. The functions are the stage values which are the approximations to , , computed by some other quadrature formulae on the intervals as follows:

, . (4)

In most cases, explicit Runge-Kutta method is preferable because it allows explicit stage-by-stage implementation which is very easy to program using computer. However, numerical analysts also aware that the computational costs involving function evaluations increases rapidly as higher order requirements are imposed (Hall and Watt, 1976). Another disadvantage of explicit Runge-Kutta method is that it has relatively small interval of absolute stability, which is not suitable to solve stiff initial value problems (Fatunla, 1988). In view of this, we are thus taking interest in implicit Runge-Kutta method. In an implicit Runge-Kutta method, the explicit stage-by-stage implementation scheme enjoyed by explicit Runge-Kutta method is no longer available and needs to be replaced by an iterative computation (Butcher, 2003). Other than this computational difficulty, implicit Runge-Kutta method is an appealing method where higher accuracy can be obtained with fewer function evaluations, and it has relatively bigger interval of absolute stability. For excellent surveys and various perspectives of implicit Runge-Kutta methods, see, for example, Dekker and Verwer (1984), Butcher (1987), Lambert (1991), Hairer and Wanner (1991), Butcher (1992), Hairer et al. (1993), Iserles (1996) and Butcher (2003).

**NUMERICAL EXPERIMENTS AND COMPARISONS**

**Table 1:** Maximum absolute errors with respect to number of integration steps, *N* (*Problem 1*)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *N* | 3-stage sixth order Gauss-Legendre method | GKRM(4,6)-I | GKRM(4,6)-IA | GKRM(4,6)-II | GKRM(4,6)-IIA |
| 160 | 4.50361(+01) | 1.62929(-01) | 1.24304(+03) | 1.86364(+03) | 4.83810(-01) |
| 320 | 1.02504(+00) | 6.45554(-03) | 3.23311(+01) | 3.99111(+01) | 1.01077(-02) |
| 640 | 1.80772(-02) | 1.35124(-04) | 6.10190(-01) | 6.79162(-01) | 1.67310(-04) |



**Figure 1:** Stability region of GKRM(4,6)-I

**CONCLUSION**

Even though a conclusion may review the main results or contributions of the paper, do not duplicate the abstract or the introduction. For a conclusion, you might elaborate on the importance of the work or suggest the potential applications and extensions

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