

THIRD-ORDER HARMONIC MEAN RUNGE-KUTTA FORMULAE FOR SOLVING ORDINARY DIFFERENTIAL EQUATIONS

(Rumus Runge-Kutta Min Harmonik Peringkat Ketiga
bagi Penyelesaian Persamaan Pembezaan Biasa)

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ABSTRACT

The conventional arithmetic mean used in the formulation of the new Runge-Kutta method has resulted in the introduction of a number of new formulae for the numerical solution of ordinary differential equations. This study discusses the derivation of a third-order Runge-Kutta method using the harmonic mean averaging of the functional values. The accuracy of these new Runge-Kutta formulae is numerically tested and the stability is examined.

Keywords: ordinary differential equations; Runge-Kutta method; harmonic mean

ABSTRAK

Perumusan kaedah Runge-Kutta yang baru menggunakan pelbagai bentuk min selain daripada min aritmetik sedia ada mampu menghasilkan beberapa rumus baru yang berupaya menyelesaikan persamaan pembezaan biasa secara berangka. Kajian ini membincangkan penghasilan kaedah Runge-Kutta peringkat ketiga yang menggunakan min harmonik sebagai pemurataan bagi nilai fungsinya. Kejituan rumus baru yang dihasilkan diuji secara berangka dan kestabilan kaedah turut diteliti.

Kata kunci: persamaan pembezaan biasa; kaedah Runge-Kutta; min harmonik

References

- Ahmad R.R. & Yaacob N. 2005. Third-order composite Runge-Kutta method for stiff problems. *International Journal of Computer Mathematics* **82**: 1221-1226.
- Evans D.J. & Sanugi B.B. 1986. A New Third Order Runge-Kutta Method for Solving Ordinary Differential Equations. *Computer Studies Rep.* 281. Loughborough University of Technology.
- Sanugi B.B. & Evans J.D. 1993. A New Fourth Order Runge-Kutta Formula Based on Harmonic Mean. *Department of Computer Science Rep.* 779. University of Technology Malaysia.
- Wazwaz A.M. 1990. A modified third order Runge-Kutta method. *Appl. Math Letter* **3**: 123 - 125.
- Wolfram S. 1991. *Mathematica: A System for Doing Mathematics by Computer*. 2nd Ed. Massachusetts: Addison-Wesley Publishing Company.
- Yaacob N. & Sanugi B.B. 1997. A Fifth Order Five-stage Runge-Kutta Method Based on Harmonic Mean. *Theory Numerics and Applications*. Dordrecht: Kluwer Academic Publisher.

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