*2nd order Huen method*



*Where*



*2nd order Cauchy –Euler*



*Where*



*Classic Runge-Kutta Third Order*

*This method is a third order Runge-Kutta method for approximating the solution of the initial value problem*



*which evaluates the integrand, f(x,y), three times per step. For step i+1,*

*This method is a third order procedure for which Richardson extrapolation can be used.*



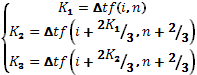
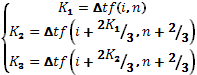
*Where*



*Nystrom Method 3rd order*



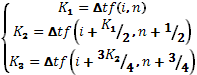
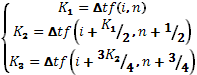
*Where*



*Optimum method (!?) 3rd order*



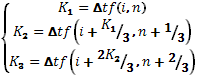
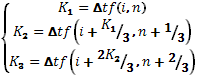
*Where*



*Heun 3rd order*



*Where*



Explicit multistep methods can never be A-stable, just like explicit Runge–Kutta methods. Implicit multistep methods can only be A-stable if their order is at most 2. The latter result is known as the second [Dahlquist](http://en.wikipedia.org/wiki/Germund_Dahlquist) barrier; it restricts the usefulness of linear multistep methods for stiff equations. An example of a second-order A-stable method is the trapezoidal rule mentioned above, which can also be considered as a linear multistep method.

Certain types of problems can be characterized as stiff:

* problems of the form



where and | *k* | is large.



In [mathematics](http://en.wikipedia.org/wiki/Mathematics), a **stiff equation** is a [differential equation](http://en.wikipedia.org/wiki/Differential_equation) for which certain [numerical methods](http://en.wikipedia.org/wiki/Numerical_ordinary_differential_equations) for solving the equation are [numerically unstable](http://en.wikipedia.org/wiki/Numerical_stability), unless the step size is taken to be extremely small. It has proven difficult to formulate a precise definition of [stiffness](http://en.wikipedia.org/wiki/Stiffness), but the main idea is that the equation includes some terms that can lead to rapid variation in the solution.