Answer on Question #76735 – Math – Quantitative Methods

Question

What is difference between single step and multi step method?

Solution

To approximate the solution to the 1st order IVP:

$$y' = f(x, y), \qquad y(x_0) = y_0$$

we seek the approximate value of the function y(x) at discrete points x_i:

$$y_i \approx y(x_i), \qquad x_i = x_0 + i \cdot h, \qquad h - step\ size$$

The accuracy can be numerically estimated: by halving step size (multi step method) or by increasing order (single step method).

The one-step method is that at each step of the method the accuracy of the function is determined by the difference in values between the results of the p-th and higher-order methods. This method estimates the error of the lower order scheme.

The multi-step method is based on estimating the difference between the approximate value of the function obtained using step size h and the approximate value of the function obtained using step size h/2. Thus, it is required to calculate three times the approximate value of the function (once with step size h and twice with step size h/2). This method requires much more calculations.