3450:427/527 Applied Numerical Methods I, Kreider

A Note on Regula Falsi (Homework 2 problem 3)

The simple regula falsi algorithm I presented in class has a flaw. At each iteration, the algorithm corrects the current best guess c by subtracting the term (b-a)\*ya/(yb-ya). Under certain conditions, this term goes to zero in double precision; this happens for some of the roots in problem 3 in the homework.

When the method has zoomed in closely to the root, so that the values of a and b are nearly the same but (b-a) has not yet reached the tolerance, the reciprocal slope (b-a)/(yb-ya) equals a constant that is multiplied by ya. If the value of ya is too small (we are near the root, after all, so ya should be small), it can happen that the correction term (b-a)\*ya/(yb-ya) is essentially zero in double precision, which means that the value of c is not changed from iteration to iteration.

To eliminate the possibility of this happening, we need to modify the convergence criterion. Instead of looking at only the absolute error (b-a), we should also look at the magnitude of the function value. When either of these is small enough, we accept the current value of c as the root. The implementation in MATLAB uses a logical ‘or’ instead of ‘and’:

if ((b-a)<tol) | (abs(yc)<tol)

break

end

The symbol | is above Enteron the keyboard, and represents ‘or’ while & represents ‘and’.