

Software for Delay Differential Equations: Accurate Approximate Solutions are not Enough

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Abstract

Numerical methods for delay differential equations (DDEs) are traditionally developed and assessed on the basis of how well the accuracy of the approximate solution is related to the specified error tolerance on an adaptively-chosen, coarse mesh. This may not be appropriate in many applications that require visualization of an approximate solution on the entire interval of interest or the determination of the 'average' values or the 'extreme' of some solution components.

In this investigation we will identify modest changes in the standard error-control and stepsize-selection strategies that make it easier to develop, assess and use methods which can solve DDEs more effectively. The required changes will typically increase 'the cost per step by up to 40%', but the improvement in reliability and efficiency will be significant. Numerical results will be presented for such modified methods applied to a selection of problems that typically arise in practice.