

CSC2322H

Project

October 28, 2011

University of Toronto

Due: End of Fall term 2011

As you know, part of the evaluation in this course is to be based on a project. The particular choice of topic is up to you, but some typical examples are outlined below to give you a feeling for the scope and focus that is expected. If you wish you may choose one of these topics but, to avoid duplication, please consult with me when choosing the particular solvers and problem class. If you choose a different project, for example one that may involve the use of BV-solvers in an interesting application area, or an elaboration of one of the exercises in the text, please have the topic approved by me in the next few weeks. In any event, The following project outlines will help you in determining the expected depth and scope of your project.

Example Project:

A detailed comparison of the performance of two BVP methods on a particular class of problems. Choose two general purpose BV methods and compare their performance on an interesting class of problems. An example of how this can be done is presented on pp. 125-129 of the lecture notes, where the methods COLNEW and MIRKDC are compared on a family of Swirling Flow problems [p. 23 of text]. (See also the paper "Runge-Kutta Software with Defect Control for BV ODEs", Siam J. Sci. Comput., 17, 2, pp. 479-496, 1996.). Methods that can be used in such an investigation include COLNEW, MUSN, MIRKDC and the Matlab routines `bvp4c` or `bvp5c`. In addition, three new BVP solvers have been developed in Matlab and discussed in a paper to appear in ACM TOMS by F. Mazzia et.al.. A copy of this paper as well as the Matlab source code for the solvers is available from me on request. [If one of these three solvers is chosen for a performance comparison, contact me to obtain the required matlab source files.]

Note that I would expect such a comparison of two methods to involve one method that was not discussed in detail in the lectures/assignments (ie., it did not involve only COLNEW and MUSN).

A related example project would be to investigate the performance of COLNEW on a set of high order BVPs (such as the Swirling Flow problem). For these problems you would compare the relative performance when treating the high order problem directly with the alternative approach where you apply COLSYS to an equivalent first order system of BVPs. Several examples of high order problems are discussed in the text and others in the Cash test set available from the course webpage.

As for the choice of problems, for either of these example projects, you can select from those discussed in the text (pp.7-27), which are quite challenging or you can select from a set of test problems collected by J. Cash and linked to from the course webpage.