Computer Project #1: Solution of the two-dimensional diffusion equation using the finite volume method.

MAE 5440, Spring 2016

Date Due: Wednesday, February 10, 2015

The work you hand in must be your own, although you may discuss solution procedures with others in the class. You cannot use or look at codes that were written by students in previous semesters.

Solve the following problem numerically using the finite-volume method as discussed in class:

 ; 

with boundary conditions:

; ; ; 

This problem has the analytic solution . Consequently, we can computer errors relative to an analytic solution. (What error do you expect from a fully “iteratively converged” solution for this case?) Start with an initial guess of . Solve over a mesh consisting of 20 finite volumes in each direction (22 if you include the “thin” boundary cells).

In addition:

>The system of equations should be solved using a **point SOR** scheme.

>Your typed final report, **in ASME format**, must include:

 Introduction section (approx. 1/4 page).

 The discretized equations (typed) including representative equations for the boundaries.

 Results that must include, but are not limited to:

Contour plot of the resultant distribution of . Be sure the boundary values are included.

Demonstrate iterative convergence. (i.e., Does the solution change with further iterations?) Also include a contour plot of the error distribution.

Conclusions Section that summarizes what you have learned.

 Appendix which includes your computer code.

NOTE:

A significant part of your grade will be based on the quality of your write-up. This includes clarity and organization. Pay attention to the ASME author guidelines. Simply getting the code to work does not earn an A grade. A carefully written report is also necessary. **Your writeup demonstrates your knowledge of the solution procedure and your understanding of the results. Limit the report to 5 or fewer pages, and use the ASME meeting or journal paper format.**

**For ASME author guidelines (and a template) for conference papers, go to:**

<http://www.asme.org/kb/proceedings/proceedings/author-guidelines>

There is also a sample ASME paper on Canvas (HT2007-32018.pdf).