

26. Obtain solutions using the program duct ($b/a = 1$) for a 21^2 , 41^2 , 81^2 , and 161^2 grid both for the finite element and the finite difference method.

a) For each grid determine through iteration the optimum value of the iteration (SOR) parameter λ_{opt} , and the corresponding number of iterations N_{iter} .

b) Plot $\ln N_{iter}$ versus $\ln N$. What asymptotic ($N \rightarrow \infty$) scaling do you obtain for N_{iter} ?

c) Plot $\ln(2 - \lambda_{opt})$ versus $\ln N$. What asymptotic ($N \rightarrow \infty$) scaling do you obtain for the value of $2 - \lambda_{opt}$.

27. Use the same grid sequence (as in problem 26) for the program duct with finite differences and determine the number of iterations for Gauss-Seidel (GS) iteration. What scaling do you obtain now for N_{iter} and how does the numerical effort for the GS method compare asymptotically with the SOR method?

28. Alter the boundary condition for program duct at the minimum boundary at y to $w(x, -1) = -0.1$. Run the program with SOR and finite differences for the same grid sequence (as in problem 26). Plot one of the solutions. What are the changes for the solution and for the iteration properties?

29. Report on the progress of your work on the project.

Please turn in the solutions to the homework on Wednesday, 4/18/2007