Computational PDEs M345N10, 2019-2020, Project 2, Reporting guidelines.

The project mark, will be weighted to comprise Total 50% of the overall Module.

Please name your files in following way:

Proj2_part_1of_X_yourCID.m (all your Matlab and/or Python scripts, with X the total number of scripts etc.); Your accompanying technical report as: Proj2_yourCID.pdf.

A zipped folder will also be acceptable (ideally), in this case call your zipped folder: Proj2_yourCID.zip (etc.)

Project 2: Elliptic Problem : Guidelines

Please bear in mind, I judge your CW based on what you write in your report. So it is no good just uploading your computer programmes and saying I have done it. If your code does not work, in your report you should describe clearly how and what steps you have taken to discretise the problem and treatment of boundary-conditions; and what problem(s) you had with the code. Even then try and do some plots of quantities that you explored to verify correctness and/or convergence of your code. This way I will be able to apportion marks for appropriate effort and correctness of approach.

I mark your report based on technical argument you use and relating your findings to theory, and or expected behaviour, and the level of detailed insight you have gained from the CW. So just a few plots without any discussion does not convey to me whether you have understood your results/computations or the numerical method.

A few pointers of things to investigate and discuss in your report:

Part 1:

Please describe what you understand by *grid independence*, and thus how you determined this to be so with your numerical solutions.

Please quote the following values of the surface velocity $U_{surf} = u$ you compute for $\tau = 0.05$, to at least 4 digits, for the Jacobi, Gauss-Seidel and SOR methods at the $x-$locations $= (0.025, 0.25, 0.5, 0.75, 0.95)$, i.e. :
(a) $U_{surf}(x = 0.025)$; (b) $U_{surf}(x = 0.25)$; (c) $U_{surf}(x = 0.5)$; (d) $U_{surf}(x = 0.75)$; and (e) $U_{surf}(x = 0.95)$.

Describe your convergence criteria and why you choose it. This convergence criteria is then to be used in Part 2, in your plots of SOR convergence acceleration.

Part 3:
A reasonable τ range to consider would be: $0.001 <= \tau < 0.4$, say. Your plots should compare how U_{surf} varies between that computed in Part 1 and with Part 3 model using Eqn. 7 as you vary τ.

A nice plot would be to show how the quantity $v = \frac{\partial \phi}{\partial y}$ varies on the surface $y_b(x)$ for $0 <= x <= 1$, as you vary τ. Further plots of v along the entire $\eta = 0, x(-q : s)$ plane would also be very instructive.

Part 4:
For multigrid approach just use 2 grids, the finer grid twice the coarse grid in both (x, y) grids. Does this aid faster convergence? Show this by appropriate computer timing or convergence acceleration achieved through appropriate measures.

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