Numerical Project

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1 Functional requirement of the program

1.1 The project

The goal of this project is to simulate the movement of a fluid through different geometries. The program create a box of choosen size, builds a geometry inside it and simulates the movement of a given fluid.

1.2 The files

In order to increase readability, the project is made of several files. I made the choice to work with Object Oriented Programming.

- main.py: This file calls for the needed functions/class

- matrices.py: This file contains the class "Matrices", it builds the geometry, the different matrices to plot and stores them

- plot.py: This file plots the matrices built in "matrices.py"

- parameters.py: This file contains all the variables that can be changed by the user

- data_check.py: This file checks the variables and makes sure that the program will run

1.3 The data

This project uses several piece of data set by the user to work.

- N_x and N_y are the size of the domain

- h represents the size of a cell

- $geometry$ corresponds to the choosen geometry

- $angle$ corresponds to the angle of the widening/shrinkage geometry

- v_x is the Neuman condition

- ϕ_{ref} is the Dirichlet condition

Be careful in the case of a widening/shrinkage geometry ! In order for the program to generate a domain from one end to another, there is a restriction on the angle, if the restriction is not met, the program will output a ValueError. The restriction is as follows:

$$|angle| < \arctan\left(\frac{0.5 \times N_y - 1}{N_x}\right)$$

The angle parameter should be set in degree, the program will convert it to radians for the computation.

1.4   The outputs

As of the alpha version, the program outputs 4 pdf files, one for each plot. The filenames are set with the following rule:

$$\texttt{data\textbackslash\_geometry\textbackslash\_Nx\textbackslash\_Ny.pdf}$$