Week #1 - Mesh and projection

1 Projection - estimation of flux at mesh nodes

Use the course notes to understand the problem at hand !

In the script, `projection_square_flux.m` (located under `sessions/week_1/`), you will find an example for the creation of an unstructured mesh for the unit square. Moreover, we also give you the analytical solution of a Laplacian problem, i.e.

$$h(x, y) = \sin(\pi x) \sinh(\pi y)/ \sinh(\pi)$$

The goal of this exercice is to finish coding up the solution of a projection procedure - notably via the function partially written in the file denoted as `ProjectionFlux.m` in the `src` folder of the base Matlab code. The steps of the procedure are outlined but you need to code up the remaining parts (notably the assembly of the force vector).

After having solved the projection problem, plot the obtained component of the flux q_x and q_y on the mesh using the `trisurf` and `quiver` functions. Then compute the absolute and relative error with the exact solution for the flux (assuming a permeability coefficient of unity), e.g:

$$q_x = -\pi \cos(\pi x) \sinh(\pi y)/ \sinh(\pi)$$
$$q_y = -\pi \sin(\pi x) \cosh(\pi y)/ \sinh(\pi)$$

Finally, compare the result with the one obtained by directly evaluating the flux at the Gauss integration point of the linear triangle element.

2 Mesh of a sheet-pile wall

In this exercise, we ask you to write a matlab script to mesh the geometry of a sheet-pile wall as displayed in figure 1 using the code `refine2` (see example in `projection_square_flux.m`). Write a code where the different dimensions of the problem can be easily changed. We will use that mesh to solve the corresponding steady-state flow problem next week.

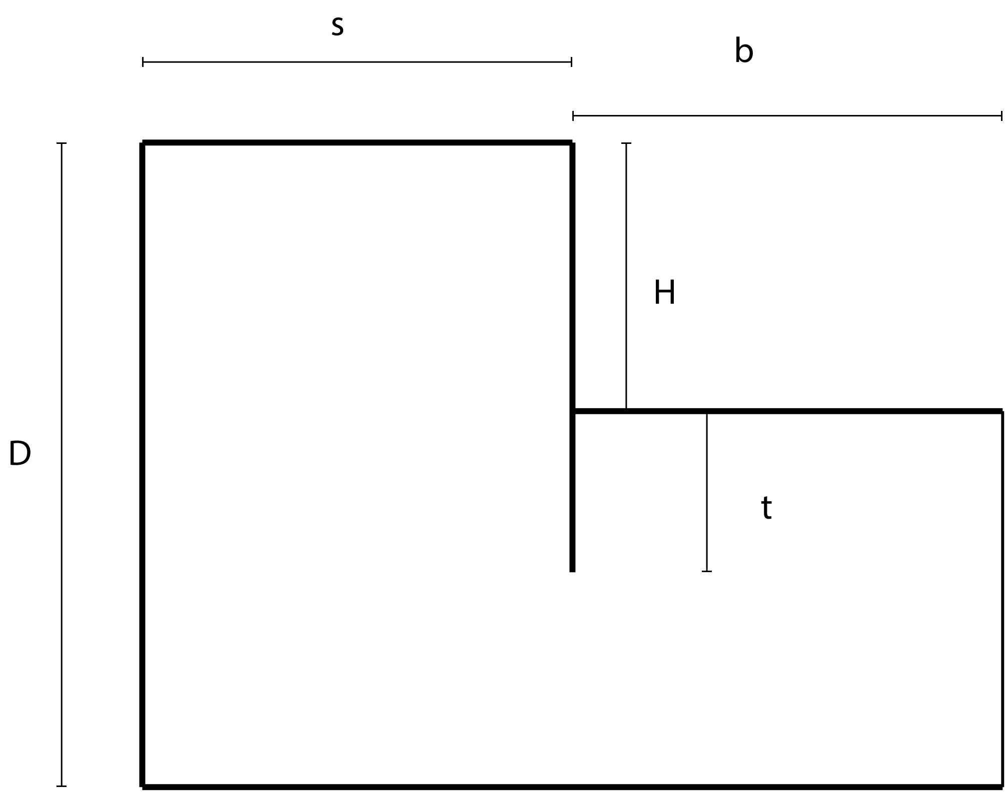

Figure 1: Sketch of a sheet pile wall.