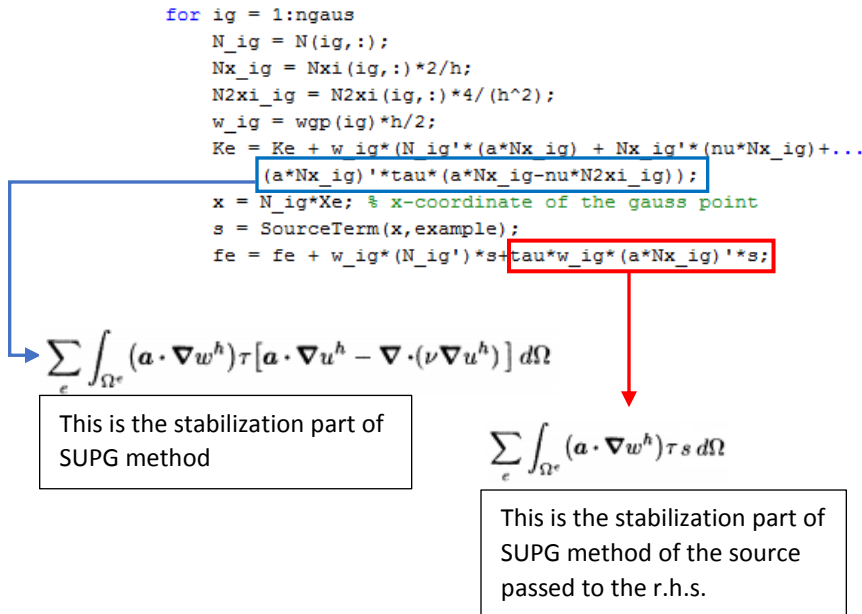


Class Homework 1: 1D Steady Convection-Diffusion

By Domingo Eugenio Cattoni Correa:

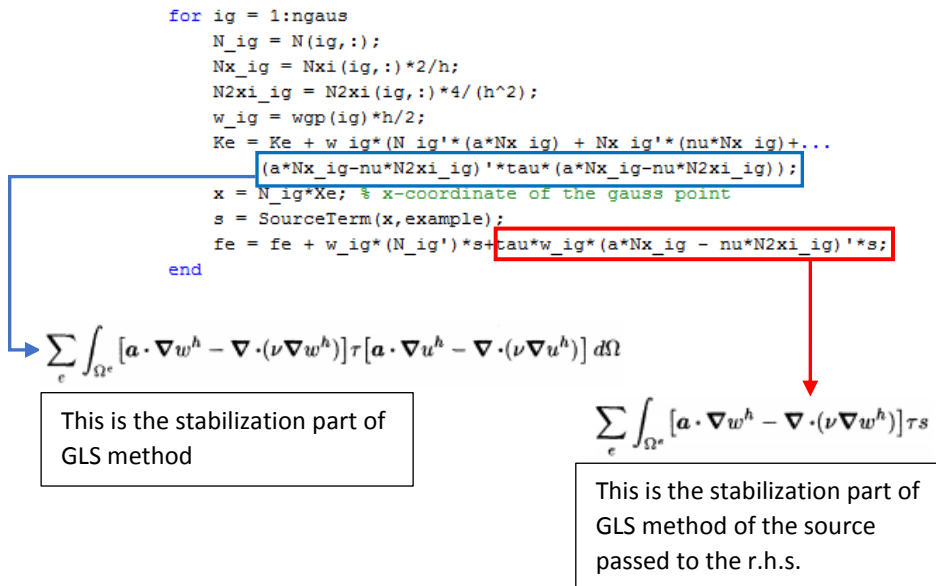
SUPG code implementation:

The next figure shows the line of the function code called "SUPG_system" where SUPG method was implemented.



GLS code implementation:

The next figure shows the line of the function code called "GLS_system" where GLS method was implemented.



Result:

It is used a mesh of 10 linear elements, with the parameters written below, in order to test the code of different methods.

$a = 1$ (convective coefficient)
 $\nu = 0.01$ (diffusion coefficient)
 $h = 0.1$ (mesh size)
 $Pe = 5$

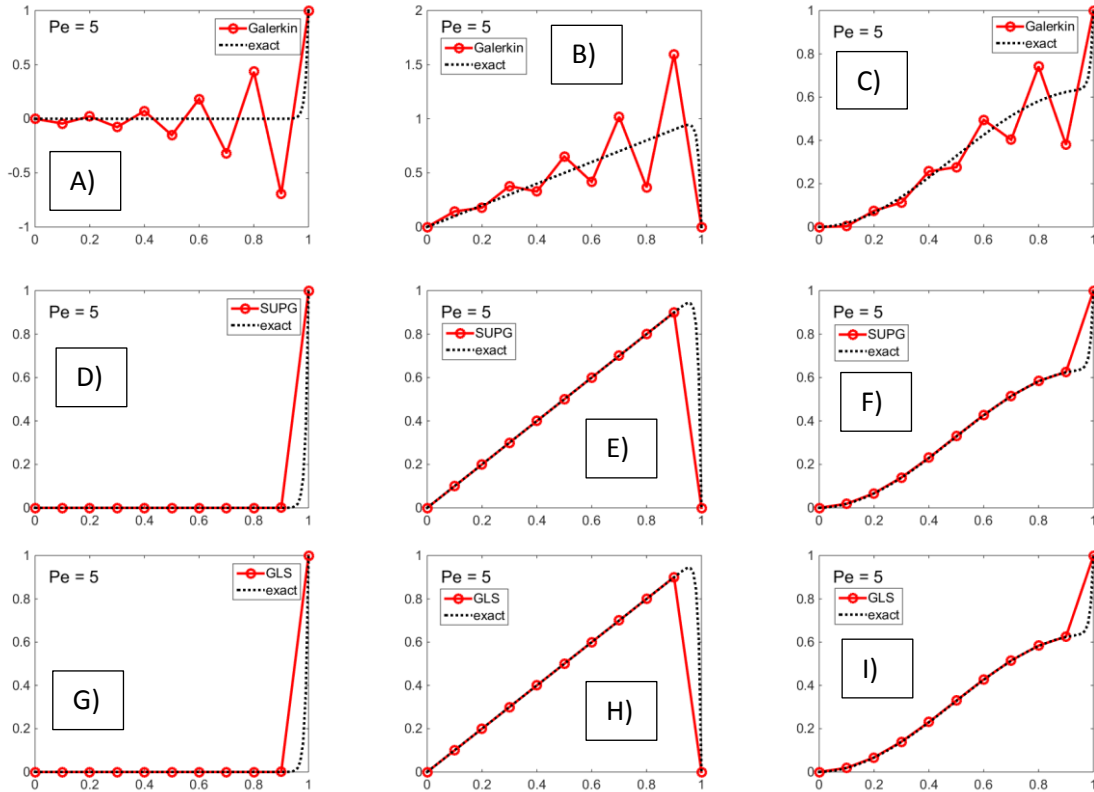


Figure 1: $au_x - \nu u_{xx} = 0$ solved by A) Galerkin, D) SUPG, G) GLS. $au_x - \nu u_{xx} = 1$ solved by B) Galerkin, E) SUPG, H) GLS and $au_x - \nu u_{xx} = \sin(\pi x)$ solved by C) Galerkin, F) SUPG, I) GLS different solutions of.

It can be seen that the solution obtained by Galerkin is corrupted by non-physical oscillations when Péclet number is larger than one (see Figure 1 A to C). On the other hand, SUPG and GLS have improved the results getting an exact solution at the nodes (see Figure 1 D to I).