

MANE 6760 (FEM for Fluid Dyn.) Fall 2022: HW1

Sep 20, 2022

Due: 11pm on Tue/Sep 27, 2022

Weight is 8% of the total grade points

In each problem state all the assumptions/choices and show the necessary steps

Submissions must be made on Gradescope

Refer to the following link for necessary input files and updates:

<https://www.scorec.rpi.edu/~sahni/MANE6760/F22/HWs/HW1/question/>

Consider the Python code provided in the course for the standard/regular (Galerkin) finite element (FE) method for steady, 1D, linear, scalar AD equation.

1. (5 points) Set $a_x = 1.0$, $\kappa = 1e - 1 = 0.1$, $\phi_L(x = L) = 0$ and $s = 1.0$. Keep all the other settings the same. Provide the plot of the FE solution along with the updated Python code.
2. (10 points) Set $a_x = 1.0$, $\kappa = 0.1(1.0 + x)$, $\phi_L(x = L) = 1.0$ and $s = 0$. Keep all the other settings the same. Provide the plot of the FE solution along with the updated Python code.
3. (15 points) Set the $a_x = (1.0 + x)$, $\kappa = 1e - 1 = 0.1$, $\phi_L(x = L) = 1.0$ and $s = 1.0$. Make sure to determine and use/encode the appropriate numerical integration rule/scheme (i.e., weights and points). Keep all the other settings the same. Provide the plot of the FE solution along with the updated Python code.