MOONS 3D NS Solver - Explicit Euler

# Governing Equations

The semi-discrete, non-dimensional form of the incompressible Navier-Stokes and mass conservation equations are:

Now, introducing

Our equations are:

Where

In order to define the boundary conditions 1 and 2, we will split our solutions into interior and boundary values as follows:

# Temporal discretization

We may now use explicit Euler for the non-linear term and implicit for the pressure term results in:

Moving all later time steps to the LHS and prior time steps to the RHS, and multiplying by , we have:

Where

# Correction Step

The pressure is unknown at time level , so we use the projection scheme by Chorin. We start by taking the divergence of

to get

Now, solve Laplace's equation for :

# First time step

The first time step requires using a self-starting method. Explicit Euler was chosen in this case. The equation for explicit Euler simplifies to no correction: