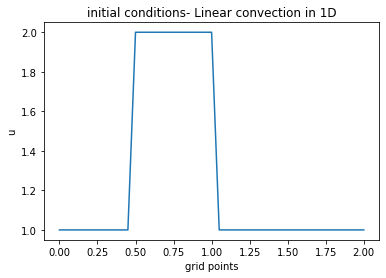
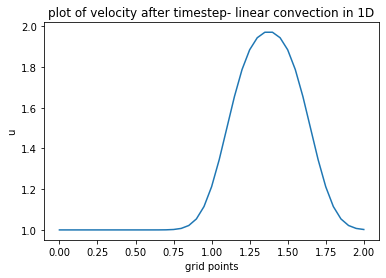
Linear Convection in 1D

Initial condition: Step function:

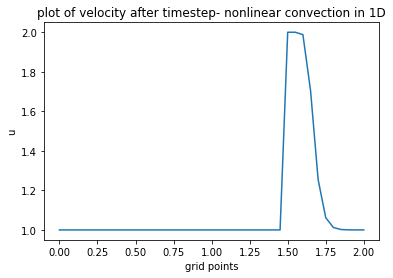


Discretization: Finite Difference Method: forward difference for time and backward difference for space



Nonlinear Convection in 1D:

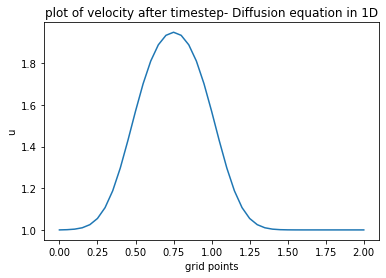
Initial condition: Same initial conditions and discretization as linear convection.



1D Diffusion Equation:

Initial condition: Hat function

Discretization: Central difference method- combination of forward and backward difference of the first derivative (since it involves a second order derivative)



Burgers’ equation in 1D:

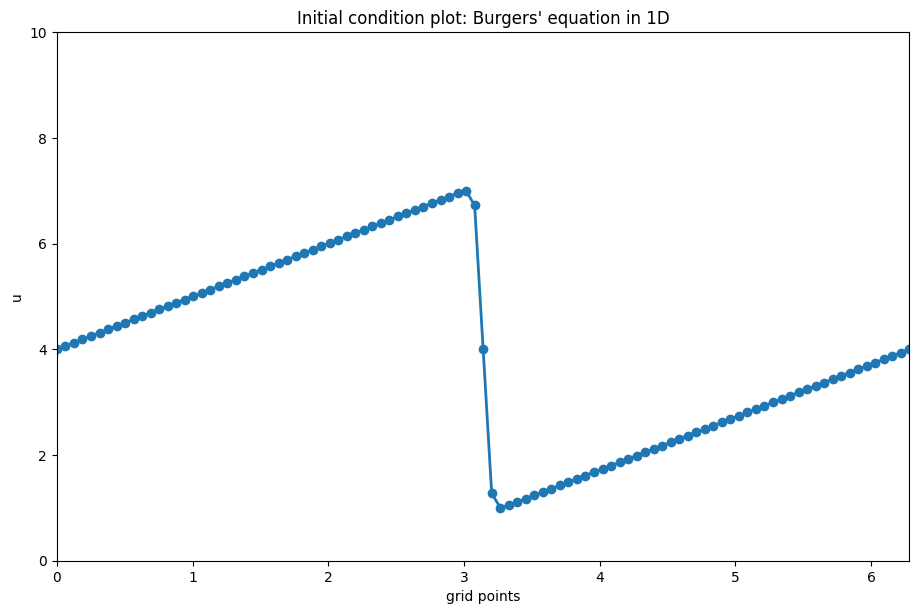
Initial condition: saw tooth function



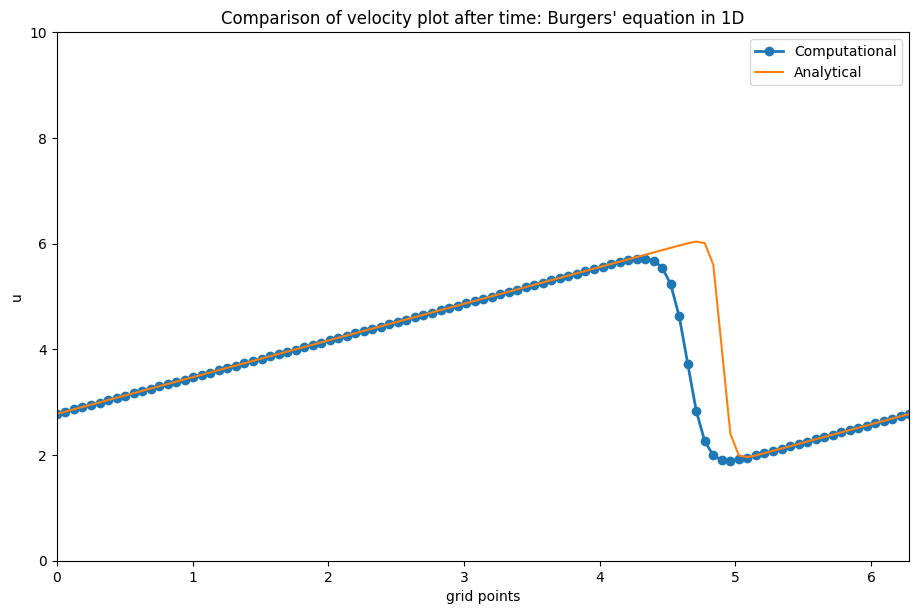
Analytical solution of the initial condition:



Boundary condition: Periodic boundary condition:



Applying the discretization and solving numerically by finite difference method and comparing with the analytical solution obtained from the initial condition solution:

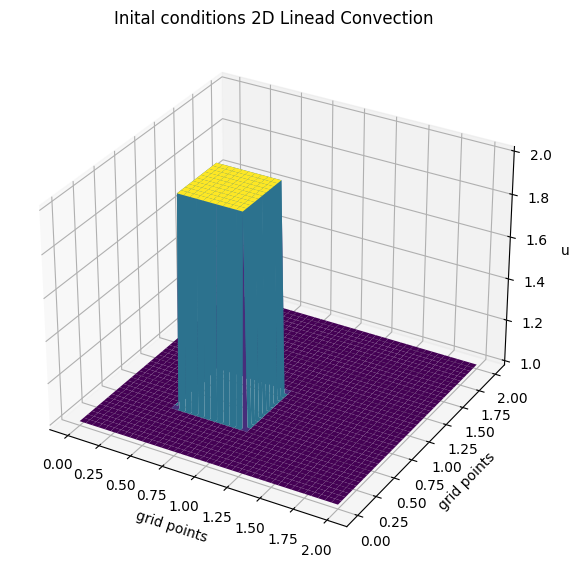


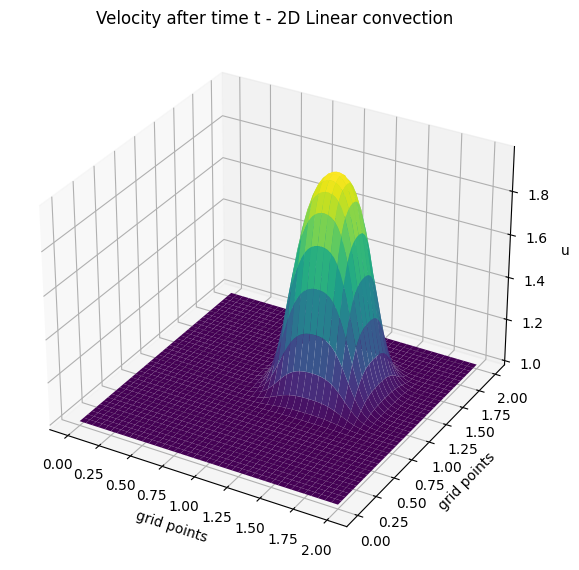
2D Linear Convection:

Same discretization with an additional subscript j

Initial condition: square function:

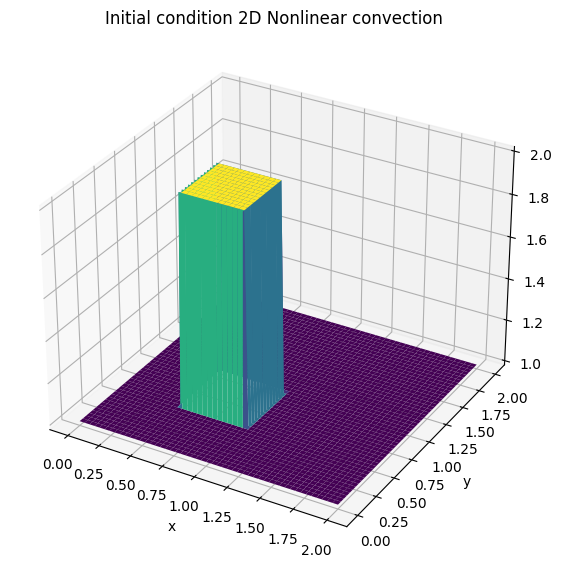
Boundary condition:



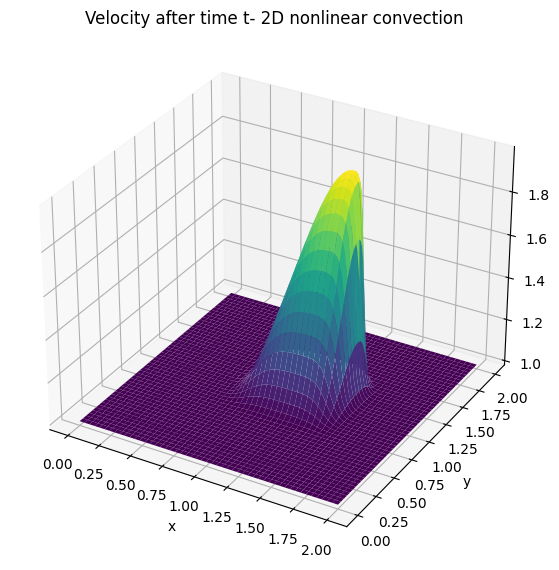


2D nonlinear convection

Initial condition: square function

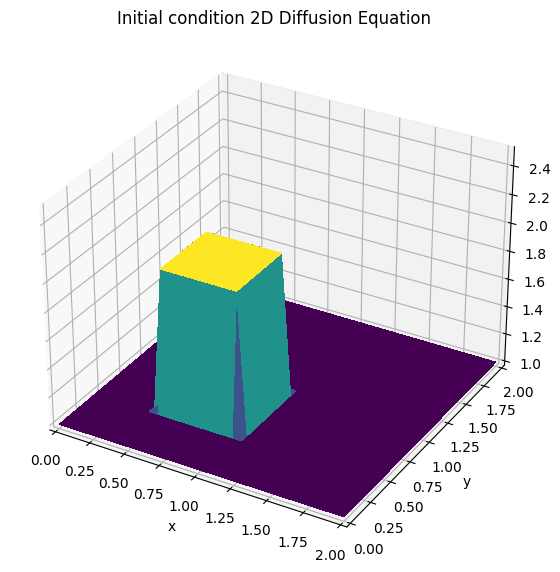


Boundary condition:



2D Diffusion equation:

Initial condition: square function:



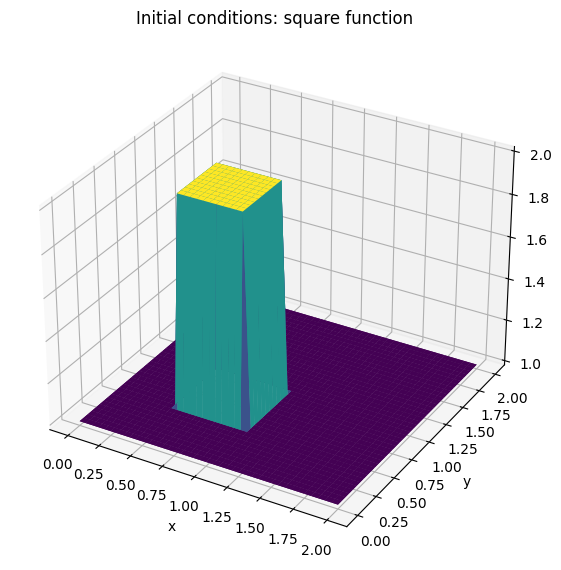
Applying finite difference:

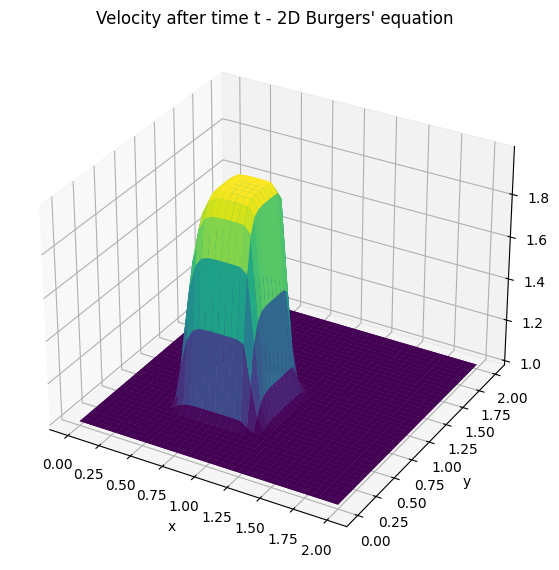
Animation

2D Burgers’ equation:

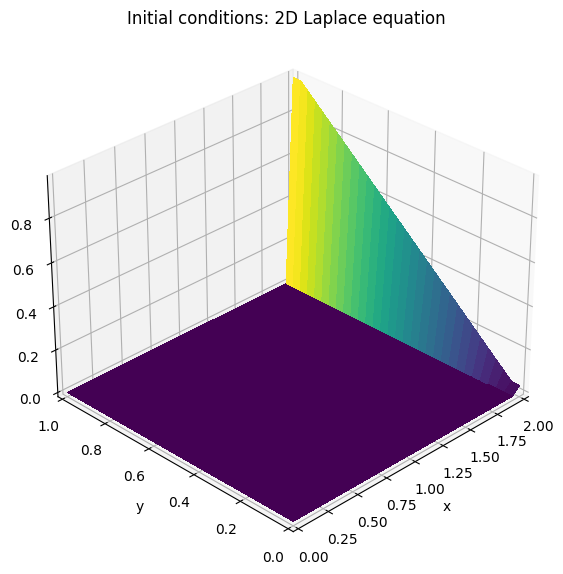
Coupled set of PDE’s:

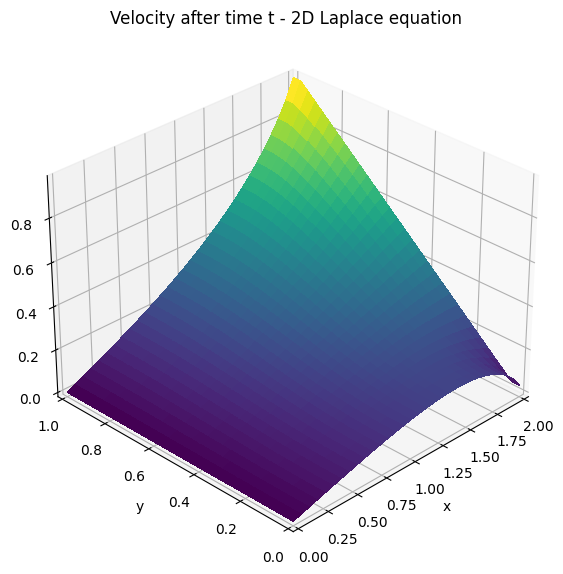
Initial condition: square function





2D Laplace’s equation:



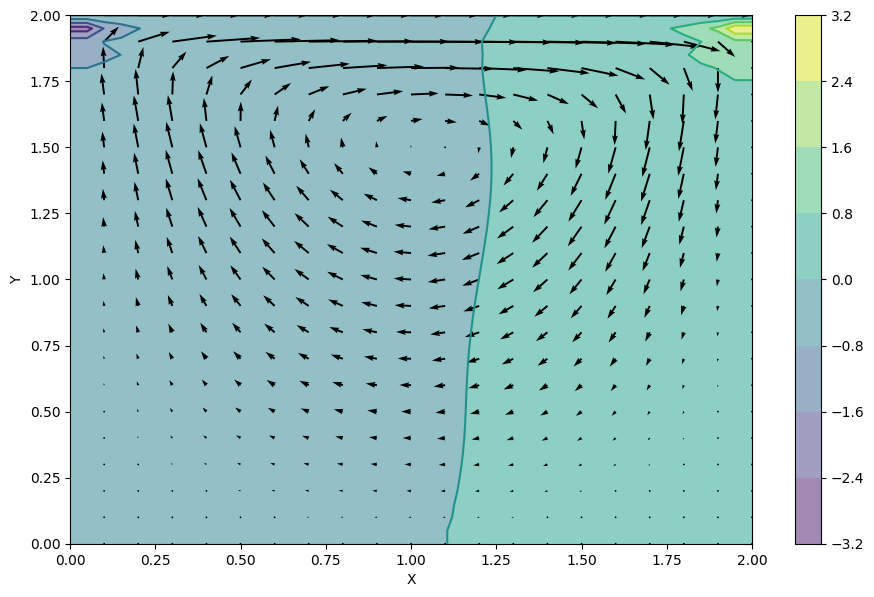


2D Poisson’s equation:

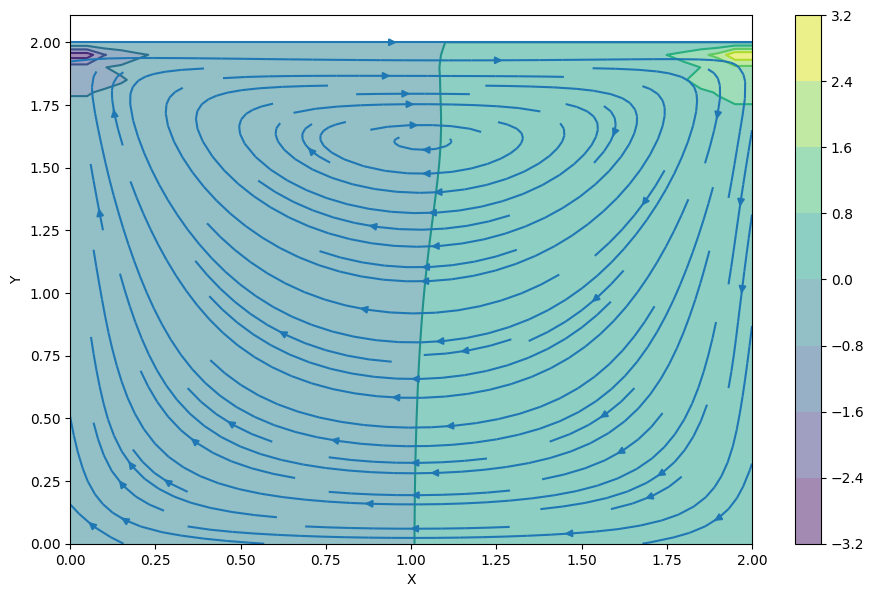
Animation

Navier-Stokes: Cavity flow

Quiver plot:



Stream plot:



Animation

Navier-Stokes: Channel/pipe flow:

Quiver plot:

