The Burgers Equation

Introduction

We have obtained numerical solution to the Burgers equation using the Adams-Bashforth 2-step and 4-step methods. The time evolution of a sinusoidal initial condition has been plotted. The chosen time-step must be consistent with the CFL condition. With increasing time, the solution develops a shock discontinuity and the evolution beyond this point cannot be tracked with this code.

Running the code

AB2

The code for the AB 2-step scheme is stored in `burgers_equation/AB2/burgersAB2.cxx`. The generated data-files are stored in `burgers_equation/AB2/results` and the image files and gnuplot scripts in `burgers_equation/AB2/images`. To run the code, from within the directory `burgers_equation/AB2/`, execute

```
g++ burgersAB2.cxx -o burgersAB2
./burgersAB2
```

This puts the data-files for each time step in `results/`.

For plotting the results, go to the directory `burgers_equation/AB2/images` and run gnuplot with following command

```
gnuplot
load 'plot.gnu'
```

This generates a plot for the evolution of the initial condition in `images/`.

AB4

The code for the AB 4-step scheme is stored in `burgers_equation/AB4/burgersAB4.cxx`. The generated data-files are stored in `burgers_equation/AB4/results` and the image files and gnuplot scripts in `burgers_equation/AB4/images`. To run the code, from within the directory `burgers_equation/AB4/`, execute

```
g++ burgersAB4.cxx -o burgersAB4
./burgersAB4
```

This puts the data-files for each time step in `results/`.

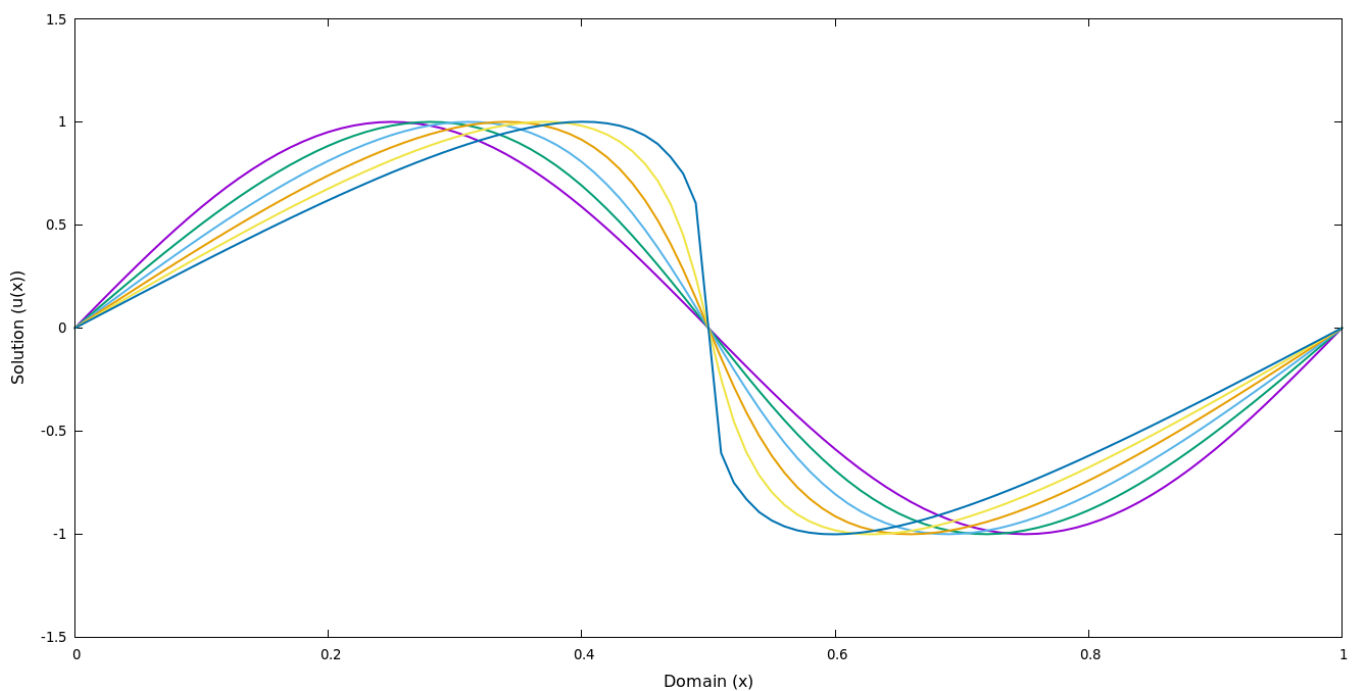For plotting the results, go to the directory `burgers_equation/AB4/images` and run gnuplot with following command

```
gnuplot
load 'plot.gnu'
```

This generates a plot for the evolution of the initial condition in `images/`.

Results

The following plots show the evolution of the initial condition *sin(2 pi x)* with time. It can be seen that the solution gradually steepens resulting in a shock formation. Time varies from 0 to 0.15 in steps of 0.001 for both schemes. The plots show 5 equally spaced (in time)snapshots of the solution.

- AB 2-step

- AB 4-step