

# Documentation of the Optional Square Wave Transportation Assessment

## 1.1 Summary

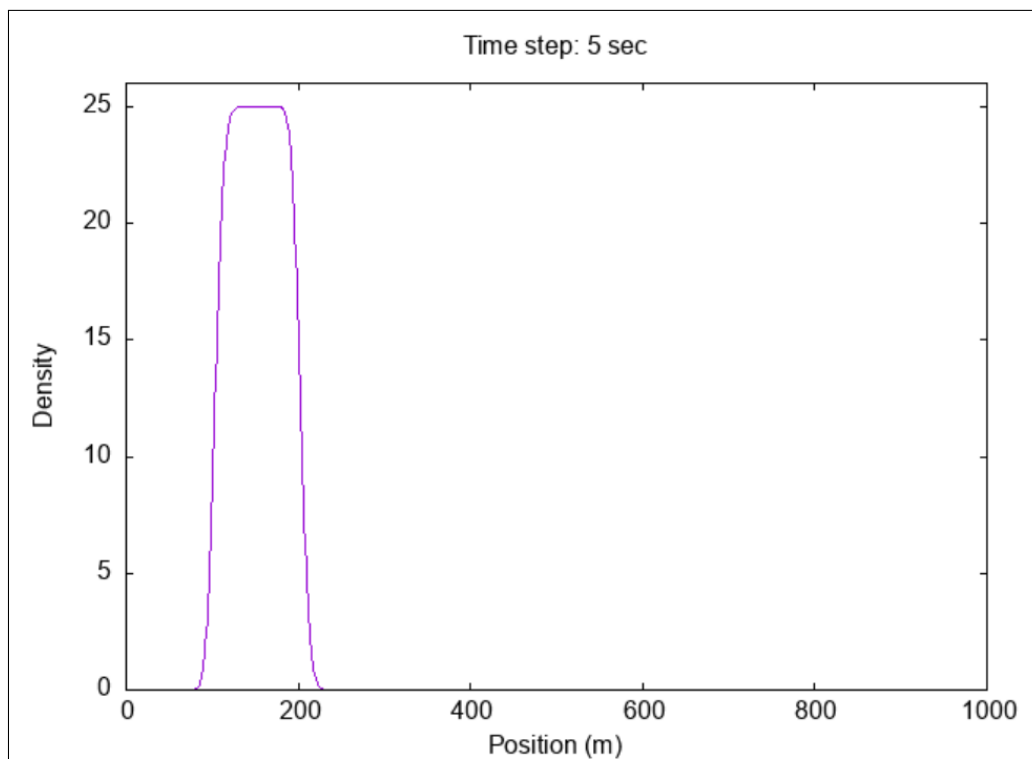
The file “wave\_transport.c” contains the C code for transporting a square wave across a 1-D structured grid. The file “create\_gif.gp” uses the output of the C code to create a 10 second GIF of the square wave being transported.

**Note:** Access to the research paper by Boris & Book referenced in the problem statement was restricted behind paywalls. Nevertheless, an attempt was made to transport the square wave as described. The flux- corrected method was not successfully implemented based on initial research found online, but a method with diffusion was successfully implemented.

Example usage in Windows command prompt:

- Build: “make”
- Run: “wave\_transport.exe && gnuplot create\_gif.gp”

Example output:



## 2.1 Implementation Methodology

The code implemented in the C file is a simple methodology using the Leapfrog technique to update the continuity and momentum equations. The following steps are taken:

1. Initialize the square wave to a density of 25.0 in cells 50 to 149.
2. Loop over the desired time span.
  - (a) Update the flux and density via continuity equation over a half time step.
  - (b) Use the density from 2(a) to update the momentum over a full time step.
  - (c) Use the updated momentum from 2(b) to update the density over a full time step.
  - (d) Save density data to a frame to be used in the final GIF.
3. Combine all frames into one GIF.