# User's guide

## Introduction.

This fold is for the numerical experiments of the Godunov type scheme for the one-dimensional Euler system with velocity, pressure and entropy as the augmented quantities. The folder should be placed in the root directory of D disk and uses Compaq Visual Fortran6 (under Windows XP) and Matlab (probably of any version). The fold contains the following folders:

1. Folder “main" contains the program (project) for the scheme.
2. Folder “Initial values" contains the programs (projects) for preparing initial values and it contains several folders:

2.1) Folder “blast waves" is for Example 5.8, the blast waves problem.

2.2) Folder “pure rarefaction" is for Example 5.2.

2.3)Folder “Riemann" is for several Riemann problems, including Example 5.3, Example 5.4, Example 5.5, Example 5.6, and Example 5.7.

2.4) Folder “Shu" is for Example 6.9, the Shu and Osher problem.

2.5) Folder “sine waves" is for Example 6.1.

Each of the above folds contains a fold "theater" that contains the Matlab files for drawing pictures for the numerical simulations.

2.6) Folder “convergence check" contains a program (project) for computing the numerical errors and convergence rates for Example 6.1 and 6.2.

2.7) Folder “boundary conditions" contains several Fortran files for treating boundary conditions.

1. Folder “Riemann\_1d" contains a program (project) for one-dimensional Riemann solver that provides exact solutions of Riemann problems for comparison.
2. Folder “input" is a folder for storing the initial values in DAT files for numerical simulations.
3. Folder “output" is a folder for storing the output values in DAT files for numerical simulations.
4. Folder “show" is a folder for storing output values of numerical simulations for drawing pictures with Matlab.

Finally, there is a BAT file “RESTORE" that deletes all the DAT files in folder “input" and copies all the DAT files in the folder "output" into the folder "input".

## Implementation.

1. Preparing initial values.

1.1) Double-click the dsw file to open the corresponding workspace (project) for preparing the initial values. For example, double-click the file “initial\_riemann.dsw" in “D:Godunov\_augmented\initial\_values\Riemann\" to open the workspace (project) for preparing the initial values for a Riemann problem.

1.2) After the “Build all" operation the user can “execute" the exe file to run the program to obtain the initial values. In the run of the programs the value of “cells number" should be provided at user's will. In the run of the programs for Riemann problems the value of “case number" should be provided at user's will.

1.3) The produced initial values are DAT files and stored in the folder “output". To compute the numerical solution the user needs first to run the BAT file “\RESTORE" by double-clicking it to copy the initial value files from the folder “output" into the folder “input".

1. Computing numerical solution.

2.1) Double-click main.dsw" in “D:Godunov\_augmented\main\main.dsw" to open the workspace (project) for the algorithm of the scheme.

2.2) After the “Build all" operation the user can “execute" the exe file to run the program to compute the numerical solution with the initial values from the folder “input". In the run of the program the values of “final\_time" and “final\_steps" should be provided at user's will. The program will be terminated by either that the “current\_ time" reaches the “final time" or that the

“current\_ step" reaches the “final\_step".

2.3) There are two parts of output results. The first part is stored in the folder “output", which is identical in form to the initial value files in the folder “input". Therefore, the user can copy these DAT files back to the folder \input" by running the file “RESTORE.BAT". After the copy the user can run the program from the previously terminated moment with a new (greater) “final time" and new “final step". The second part is stored in the folder “show" and is used for drawing pictures using Matlab.

## Visualizing numerical results.

1. The user can use the Matlab files provided in the folder "theater" in each case to draw pictures with the numerical data from the folder “show".
2. For Riemann problems, the exact solutions can be obtained by running the program in the folder “Riemann\_1d" to produce the corresponding exact solutions and store them in the fold “exact" in the fold “show". For the blast-waves problem and Shu problem the exact solutions are computed using a WENO scheme on very fine grids and are already stored in the folders “exact solutions" in the corresponding folders “theater".