

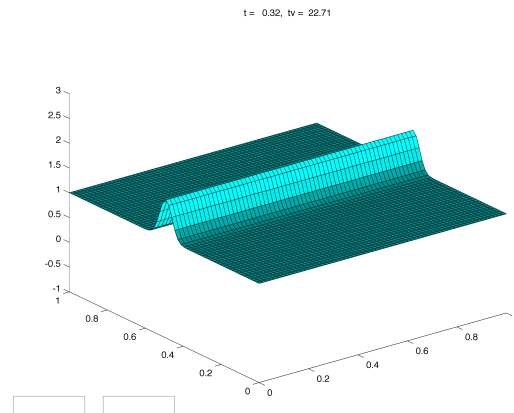
Computer Lab Assignment 10

Shallow Water Wave Equation

In this lab, we solve the shallow water wave equation for different initial conditions. The initial conditions are all you need to change. We will use a code written by Cleve Moler that is explained in his Matlab book “Experiments with Matlab”. The book is available [online](#) and chapter 16 has been uploaded to bCourses as PDF file.

(1) Download the code “waterwave03.m”, run it, and familiarize yourself with the buttons.

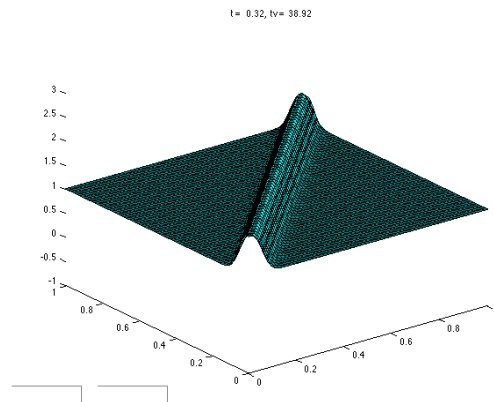
(2) At first the depth of the water is set to 1 everywhere. The initial conditions are stored in $H(2:n+1,2:n+1)$. See lines 47-51. The values at the boundary specified by the indices 1 and $n+2$ are fixed by the boundary conditions. Change the initial conditions from a droplet in such a way that you start out with a Gaussian wave parallel to the X axis as shown here:



Run it and see what happens. Print it out a snapshot, make a Christmas card out of it, and dedicate it to your grandma. Which direction is the wave traveling?

(3) Change the initial conditions so that H is set to 2 on the diagonal and left at 1 everywhere else. Compare with the figure in part (4) below. Run it and see what happens.

(4) Instead of using the discontinuous initial conditions from (3), implement a smooth wave in diagonal direction shown here:



What differences do you see compared to part (3)?

(5) Now go back to the original code that used a Gaussian droplet to start. Try to understand how the indices i and j are handled. Now modified it so that you start with 4 droplets, one near each corner of the square. Run and see what maximum amplitude you see.