1 Introduction

As a final exercise, the wave equation in one dimension gets treated by a finite difference method.

2 Algorithm Description

The second-order derivatives of the wave equation are approximated by a second-order central finite difference scheme. Periodic boundary conditions are observed by adding a ghost position beyond both ends of the interval considered for the wave equation.

3 Results

The program was implemented as described above and submitted with this report.
The proposed Gaussian wave packet was found to move in the positive x direction as expected.
For $b > 1$, the solution blows up, i.e. the numerical scheme becomes unstable as predicted by the CFL criterion.
A wave stationary for $t < 0$ was found to split in two packets moving in opposite directions. Figure 1 shows the split shortly after $t = 0$ for the same Gaussian packet as above fixed in position for $t < 0$.

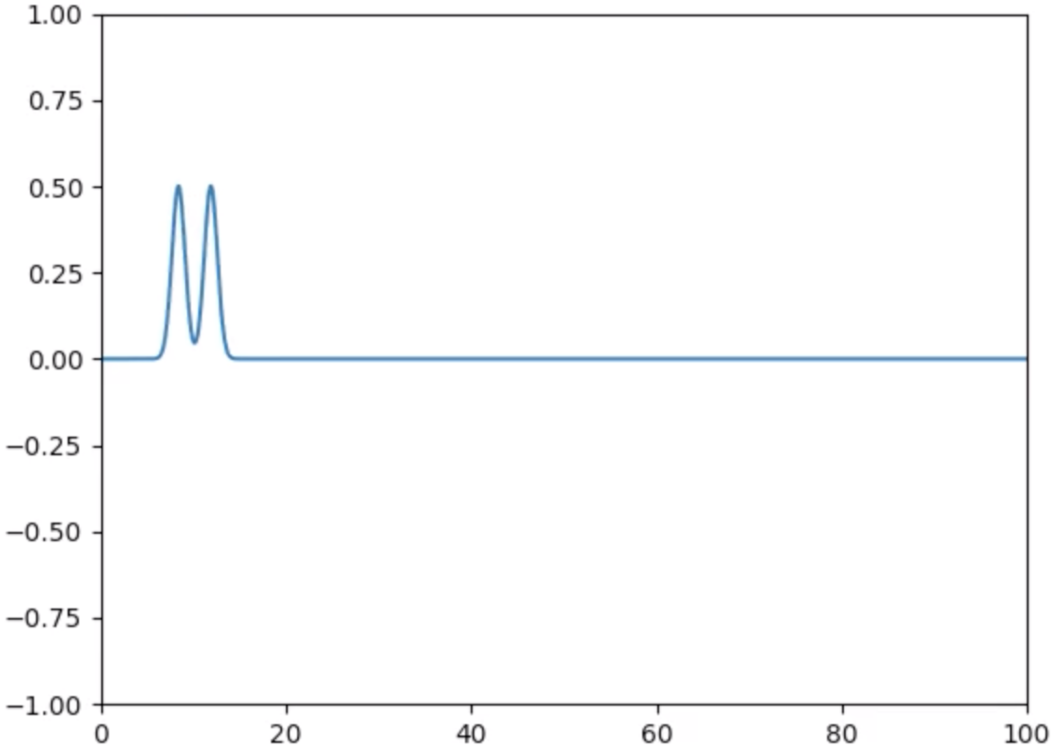

Figure 1: Split of Gaussian wave packet stationary for $t < 0$ seen shortly after $t = 0$.

4 Discussion

The results are as expected and are a lovely illustration of the strengths and weaknesses of simple numerical methods.