Numerical solutions of one dimensional magnetic strings

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Abstract

Chapter 1

Sample problems

In this chapter, several sample problems are introduced and their analytical solutions presented. These problems are to be used to test and calibrate the numerical methods. The problems consist of one dimensional elastic strings with different boundary conditions. The strings are supposed to have material qualities in order to set the wave speed to 1.

1.1 Bounded string

The sample string for the bounded string problem is a string which is initially in rest and has a triangular shape. The wave speed is 1 and so the periode is 2s. A series showing the motion in $0.1s$ steps is presented in fugures 1.1 to 1.10.

1.2 String, fixed on one end

In this test configuration, a string with wavespeed one is fixed on one end and loose on the other. The inithial shape corresponds to a cosine function and the initial speed is zero. The results are presented in Figures 1.11 to 1.17.

Figure 1.1: Initial value problem, triangular shape, t=0 and 0.1

Figure 1.2: Initial value problem, triangular shape, t=0.2 and 0.3

Figure 1.3: Initial value problem, triangular shape, t=0.4 and 0.5

Figure 1.4: Initial value problem, triangular shape, t=0.6 and 0.7

Figure 1.5: Initial value problem, triangular shape, t=0.8 and 0.9

Figure 1.6: Initial value problem, triangular shape, t=1.0 and 1.1

Figure 1.7: Initial value problem, triangular shape, t=1.2 and 1.3

Figure 1.8: Initial value problem, triangular shape, t=0.4 and 0.5

Figure 1.9: Initial value problem, triangular shape, t=1.6 and 1.7

Figure 1.10: Initial value problem, triangular shape, t=0.8 and 0.9

Figure 1.11: Initial value problem, a string fixed on one end, t=0 and 0.5

Figure 1.12: Initial value problem, a string fixed on one end, t=1 and 1.5

Figure 1.13: Initial value problem, a string fixed on one end, t=2 and 2.5

Figure 1.14: Initial value problem, a string fixed on one end, t=3 and 3.5

Figure 1.15: Initial value problem, a string fixed on one end, t=4 and 4.5

Figure 1.16: Initial value problem, a string fixed on one end, t=5.0 and 5.5

Figure 1.17: Initial value problem, a string fixed on one end, t=6