Homework 5: Waves On a String Analysis

Daniel Bristow

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Introduction

Two strings are considered: an ideal string and a realistic string. The strings have the same sizes. A Gaussian pluck is applied to the same positions on both strings with the same parameters.

Method

We use the Gauss-Seidel relaxation method to solve the wave equation governing state of the string for a given range of time. We preform a fast-Fourier transformation at the middle of the string for and use it to find a power spectrum of frequencies.

Verification of program

The animation of the strings (see program) are accurate and the first peaks occur at fundamental frequency (the lowest frequency with a peak).

Data

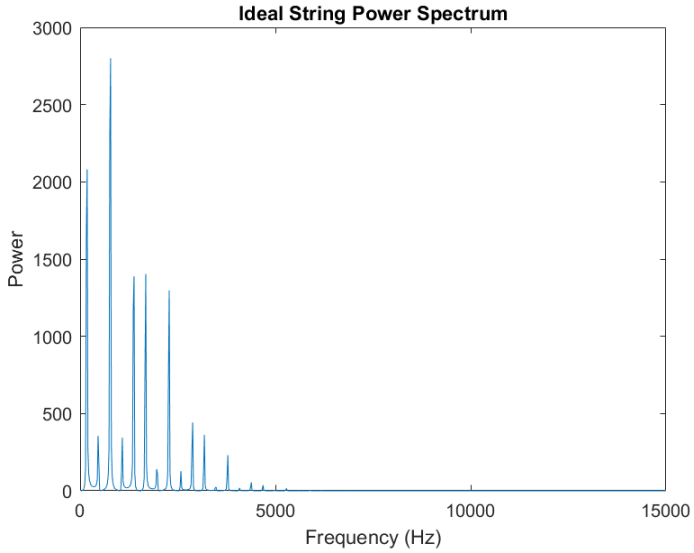

Figure 1: Power spectrum of ideal string.

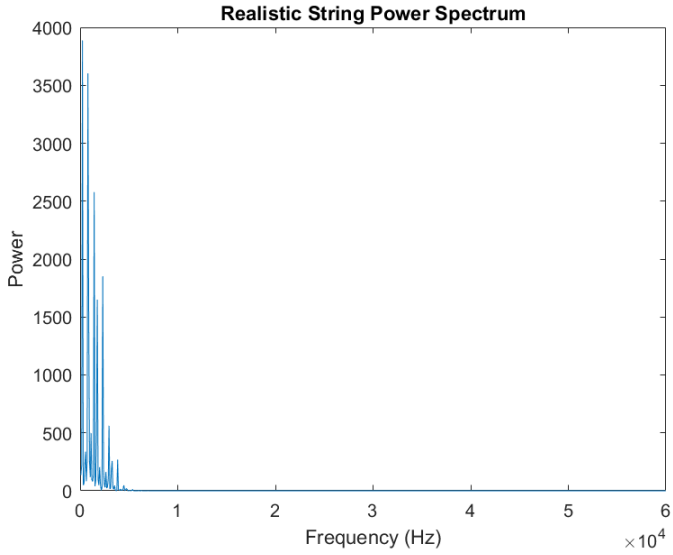

Figure 2: Power spectrum of realistic string.

Analysis

Looking at the arrays in the program, the first peaks in the power spectrum only occur *near* the fundamental frequency rather then *at* the fundamental frequency. However, could simply be revolved by increasing the amount of time iterated.

Observing the motion of the ideal string versus the realistic string, the ideal string maintains its shape each time it is reflected off of the walls while the realistic string begins to dissipate as its shape 'dissolves' (see the animation).

Critique

I have gained a better understanding of the fast-Fourier transformation and its use in finding the power spectrum.