Graphical Visualization Modules in MATLAB for teaching Communication and Signal Processing Concepts

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Abstract

Communication can be viewed as an essential tool since the dawn of human existence. Communication has changed and evolved. At the very beginning, people communicated with graphical words, to nowadays, different countries have their own languages.

Communication is not only restricted to people; it can be between cellular phones through the base station, and between computers located anywhere in the world.

Communication has become more and more advanced and most communication systems now use digital signal processing. The knowledge and concepts behind digital signal processing become more complex and abstract. A visualization method is now required to help people improve their understanding of the concept.

Objective

The aim of this project is to create a visualization tool to interpret the abstract concepts of communication systems and signal processing for teaching purposes.

Some basic signal processing and advanced digital signal processing concepts are presented with a graphical user interface (GUI).

The visualization tool should present the concepts in such a way that makes the user easily understand and have a user-friendly interface.
Methodology

Stage 1: Design the visualization methods to present the project
Stage 2: Design the graphical interface with familiar and interactive purpose
Stage 3: Program the interface

In this project, software called MATLAB is being used to design the visualization tool. The MATLAB graphics system is an effective and powerful object oriented approach based on the simple paradigm of parent-child relationships between some of the objects.

Result

Graph of Convolution tool

Window of showing the process of convolution

This tool is designed to show the concept of convolution which allowing the user:
- Designing different type of signal
- Changing the value of ‘n’

Window of designing the signal
Graph of Constellation Diagram tool

There are three main tasks of this tool:
- Showing the graphical representation of the different digital modulation schemes
- Comparing the bit error rate of different digital modulation schemes
- Simulating the condition with your own speech

Graph of Signal Property tool

This tool is mainly separated into three parts:
- Showing the Transformation of Signal and its Fourier Transform
- Showing the Property of Frequency Shifting
- Showing the Property of Modulation