Frequency Adder -Java Based Web Application

USER-MANUAL

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1. Introduction

Frequency Adder is a Java based web application to generate and add two different frequency signals ranging from 0 to 48 kHz with different amplitude and phase. It gives the user freedom to choose either to generate a single frequency or the sum of two frequency signals. It also lets the user to choose the sampling rate of choice. Moreover user can choose either to play the signal or to save it in a .wav file of 4 seconds. The GUI looks as follows:
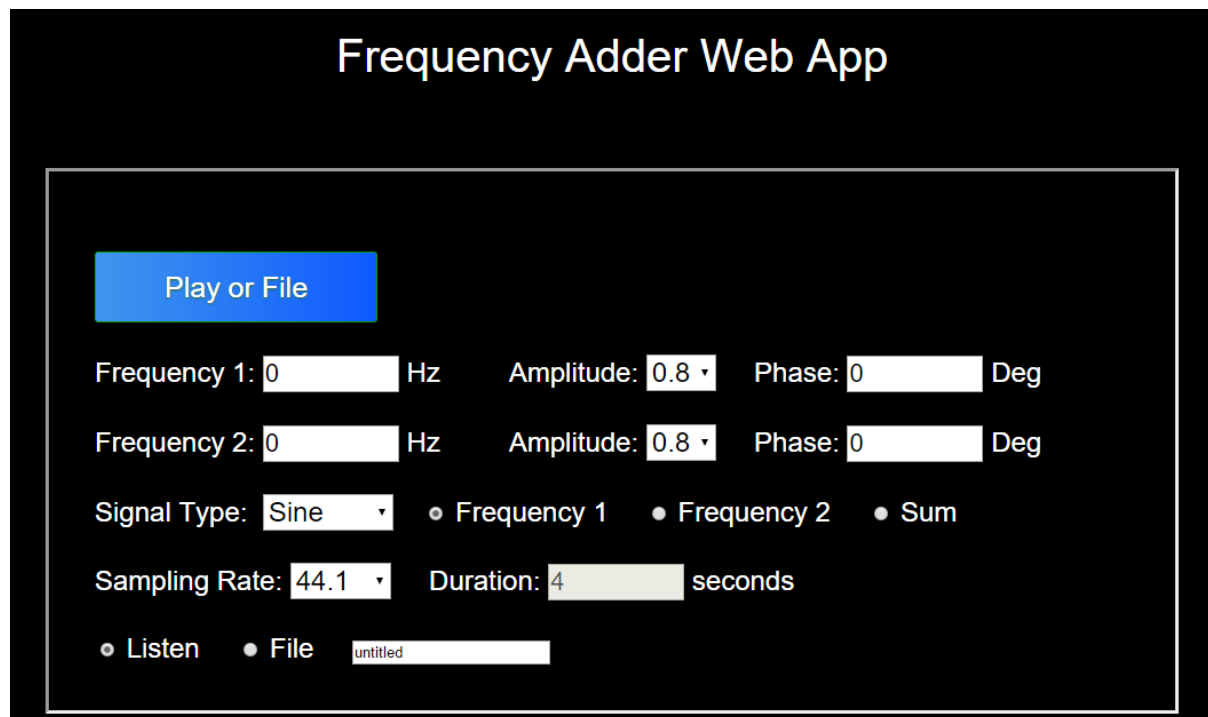

Figure 1: Frequency Adder Java based web application

GUI contains a "Play or File" button, fields for Frequency 1 and 2, Signal Type selection, options field to select frequency 1, 2 or sum, a sampling rate field for choosing different sampling rate, duration field to show the length of .wav file in seconds and options either to choose to listen it directly or save it in .wav file. There is also a text filed for naming the audio file. If user doesn't give it a name, then untitled.wav is chosen by default. Following is the range of input fields.

Frequency: 0 to 48000 Hz

Amplitude: 0.1 to 1.0

Phase: 0 to 359 Degrees

Signal Type: Sine, Triangle, Square

Sampling Rate: 8, 16, 22.5, 32, 44.1, 48, 88.2, 96 samples/second

Filename: any text (untitled by default)

2. Run Time Environment Set Up

2.1 Installing Java

To install Java in your development environment do as following

Overview

All Java code runs inside a Java Virtual machine (JVM). The system that provides the JVM is referred to as the Java Runtime Environment (JRE). A JRE is sufficient to run Java code, but it does not contain software development tools needed by developers. For this reason, we need to install the Java Development Kit (JDK), which contains both a runtime environment and developer tools. Oracle provides the JDK in two forms: a Java Standard Edition (JSE), and a Java Enterprise Edition (JEE). The JEE contains the JSE within it, but also provides additional libraries, additional tools, and a JEE Application Server [1][2].

Installation

If Java is not already installed on your system, then you should go to Go to the Oracle website and locate the download page for the most recent release of the Java Standard Edition (SE) Software Development Kit. Optionally, you can install the documentation titled *Java SE Documentation*. Alternatively, you can simply access Oracle's online version of the JDK Documentation. The most important part of the documentation is the Java Platform API Specification.

2.2 Setting up Eclipse

To set up Eclipse on your system do as following

Overview

Eclipse is a tool for building software projects. Such a tool is also referred to as an integrated development environment, or simply IDE. Eclipse is similar to Microsoft Visual Studio, except that it is free and open source. IBM started eclipse as a proprietary, closed source project. However, after reaching a fairly advanced state of development, IBM converted eclipse into a free, community-supported open source project. The development of eclipse is now managed by the Eclipse Foundation, which is a non-profit organization.

Eclipse can be easily extended by any programmer. Eclipse comes with extensive documentation on how to do this. This is one of the reasons eclipse has gained in popularity. You can extend eclipse in one of two ways: by adding plug-ins, or by adding collections of plug-ins called features. Eclipse is written in Java, and is primarily used as a tool to build Java projects. However, eclipse can be used to build projects in any language. [1][3]

Installation

If Eclipse is not already installed on your system, go to the Eclipse website and download and install the *Eclipse IDE for Java Developers*. There is no installation program for Eclipse. Instead, unpack the compressed archive that you downloaded and unpack into a convenient location. You launch Eclipse by running the Eclipse executable file.

3. Deploying the App on a Server

3.1 Apache Tomcat

To run the web you need a server. Apache Tomcat is the best option as it is open source. To install the Apache Tomcat do as following

Overview

Tomcat is a JEE Web Container, which means it is a Web server and a platform to run Java Servlets and JSP. Tomcat is an open source project managed by the [Apache Software Foundation](#).[1][4]

Install Tomcat

Go to [the Apache Tomcat web site](#), and navigate to the download page for the most recent release of Apache Tomcat version. At the time of this writing, this was *8.0.30*. Download a binary release of the *Core* distribution for your system. Under Windows, you can use the *Windows Service Installer* or zip file. Under Linux or Mac, you should download the file ending with the .tar.gz extension.

The following command illustrates how to expand a .tar.gz file under Linux.

tar -zxvf file-name.tar.gz

If you downloaded the Windows service installer, then run it to install Tomcat. Otherwise, follow the instructions in the distribution or on the tomcat web site to install tomcat on your system.

In this manual, the folder in which tomcat is installed is referred to as ${TOMCAT_HOME}.

Test

After installation is complete, test that everything is OK. Under Windows run *Configure Tomcat*, which is found through the Start Menu. After starting Tomcat, go to the following URL in a browser to see if tomcat is running.

http://localhost:8080/

Running App on local host

In order to run the App, First import the FreqAdder folder into eclipse workspace. Right click on the folder. Select *Run as* then *Run on Server.* On the wizard select *Next,* if you want to remove existing projects on the server, you can remove them. After that select finish.
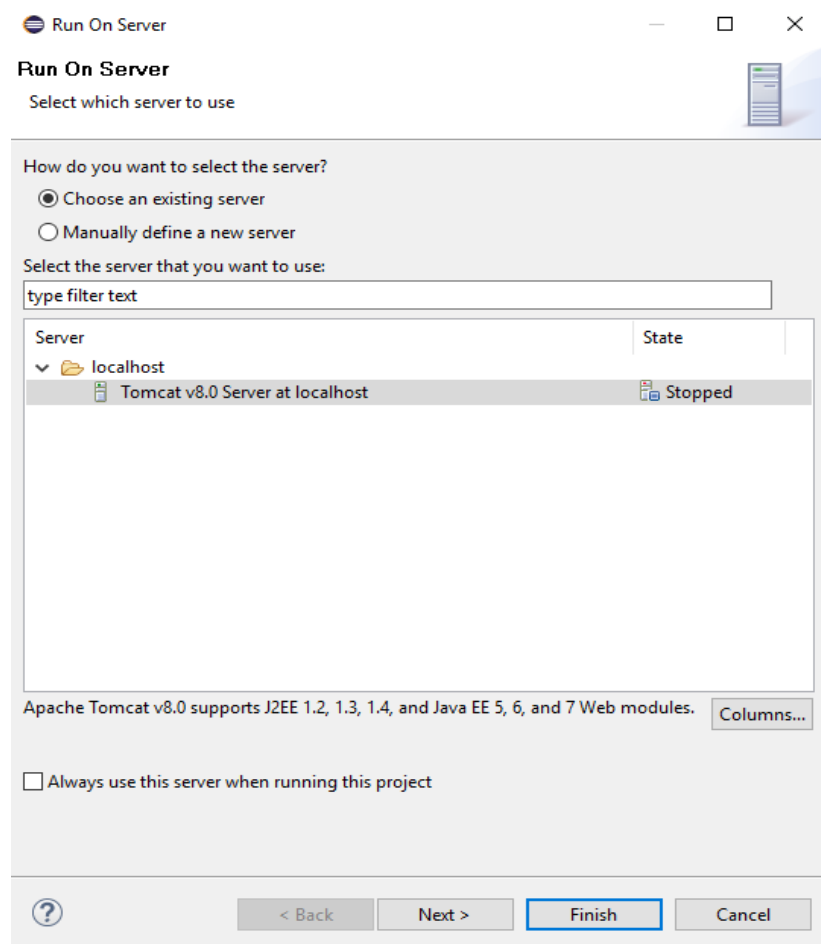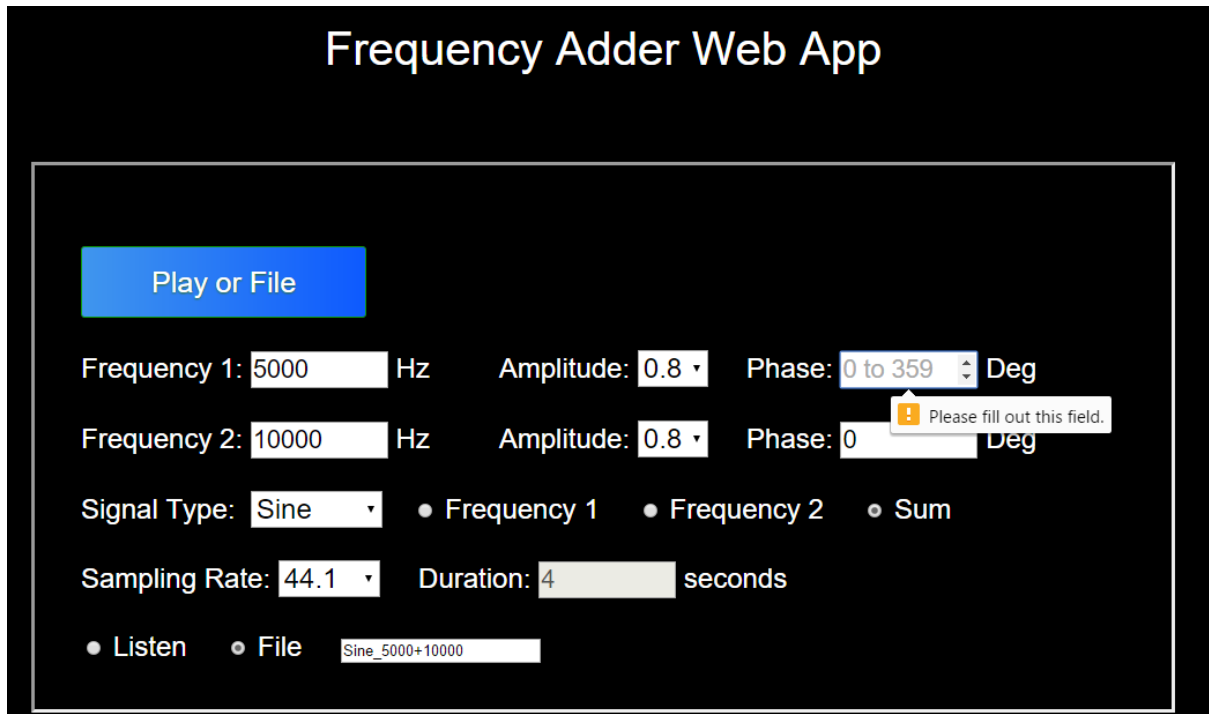

Figure 2: Run on Server wizard Eclipse

To see the app running on server, Go to the browser and type this URL: http://localhost:8080/FreqAdder

4. Using the App

This App is built to generate and add two frequency signals. All you need is to add the values of Frequencies, select the amplitude and add the phase (by default 0). If you don't fill out any field, it gives the message, "Please fill out this field." Application gives you the choice to hear the generated signal or to save the generated signal in .wav file. Following is the demonstration of filling out the input fields.

Figure 3: Inserting values in the web app

The range of frequency is 0 to 48 kHz, amplitude 0.1 to 1.0, phase 0 to 359 Degrees. First, enter the value of frequency 1 and then enter the values for frequency two respectively. After that, select the Signal type, it can be Sin, Square or Triangular. Then select one of the options for either to generate the signal distinctively or to generate the sum. Select the sampling rate according to the Nyquist Theorem. It should at least twice as much the highest frequency signal. In the end, select Listen to hear or File to save, give your .wav file a name and press the Play or File button. A .wav file will be downloaded in to your Downloads directory of the system.

5. Results

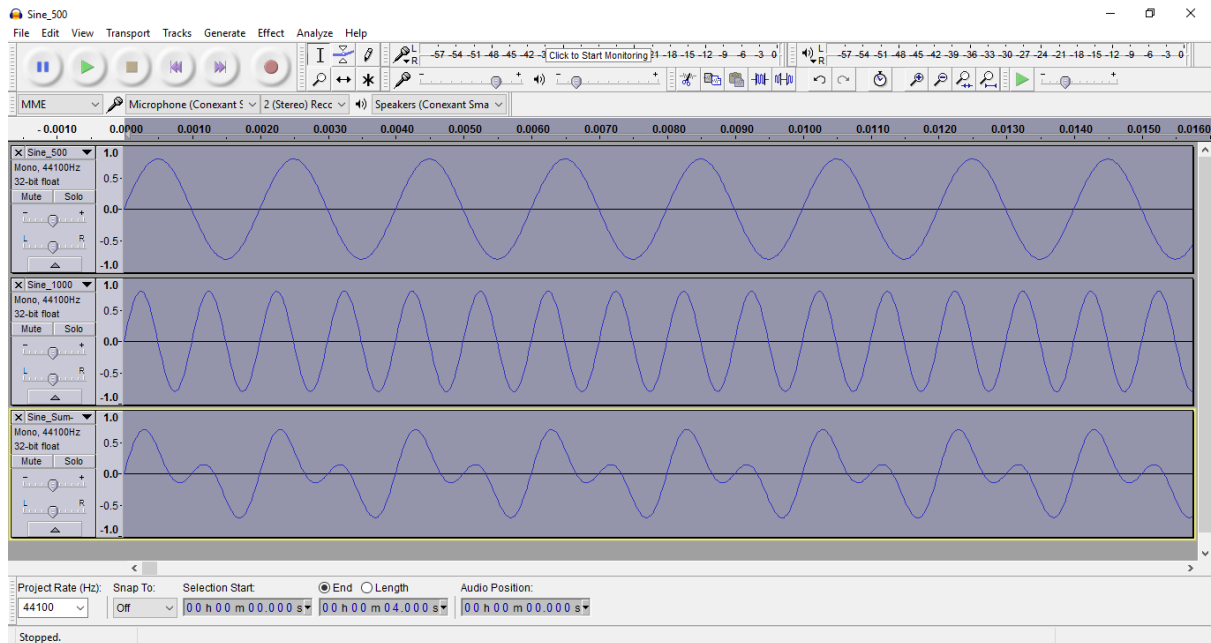An audio file with 16 bit, signed, PCM encoded is downloaded and analysed with Audicity software.

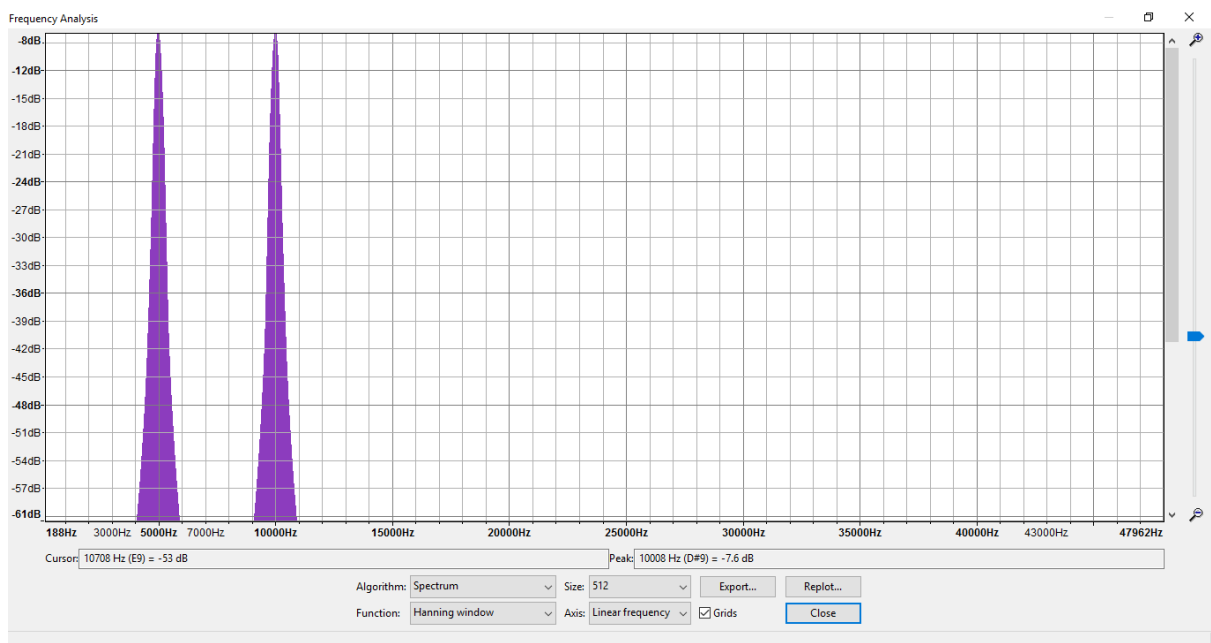*Figure 4: Audio wave form of Frequency1(5000Hz), Frequency2(10000Hz) and Sum*

Figure 5: Frequency Spectrum

References

[1] http://cse.csusb.edu/turner/java_web_programming/

[2] https://www.oracle.com/

[3] http://www.eclipse.org/

[4] http://www.apache.org/