**Karaoke Virtual Instrument (VI)**

**Background**

Source: [https://decibel.ni.com/content/docs/DOC-17158](https://decibel.ni.com/content/docs/DOC-17158)

Most popular and rock music recordings use multiple microphones and mixers to generate the left and right signals. Listening in stereo gives a broad presence to the music. Adding these signals together affects the volume but not the musical content. On the other hand, subtracting the signals removes the vocals. The vocals are considered most important, and these are often recorded identically on both left and right channels. The background music due to the stereo mixing has no phase (time) relationship between the channels. If you subtract the channels (which can be accomplished by inverting one signal and then adding them together), the vocal signals are cancelled. This procedure often has the most profound effect on the lead singer and not the background vocals or instruments.

**Virtual Instrument (VI)**


Virtual instrumentation is the use of customizable software and modular measurement hardware to create user-defined measurement systems, called virtual instruments. Traditional hardware instrumentation systems are made up of pre-defined hardware components, such as digital multimeters and oscilloscopes that are completely specific to their stimulus, analysis, or measurement function. Because of their hard-coded function, these systems are more limited in their versatility than virtual instrumentation systems. The primary difference between hardware instrumentation and virtual instrumentation is that software is used to replace a large amount of hardware. The software enables complex and expensive hardware to be replaced by already purchased computer hardware; e.g. analog-to-digital converter can act as a hardware complement of a virtual oscilloscope, a potentiostat enables frequency response acquisition and analysis in electrochemical impedance spectroscopy with virtual instrumentation.

**Karaoke VI**

Karaoke VI takes two inputs (music source with vocal and your voice) and gives one output (mixer of one input and vocal removed song) through speaker. Karaoke VI discussed here, is developed in NI LabVIEW software. NI LabVIEW virtual instruments have mainly two components as any other real instrument front panel (outer side of the box) with controls and indicators, and block diagram (inside the box) containing all the mathematical function and IO handlers. Following figure shows front panel of Karaoke VI. The front panel has four controls and two indicators.

- **Mic Pointer Slide**: Mic pointer slide can be used to control the input voice magnitude in the final output.
- **Master Volume Control**: This control is used to control volume of final output.
• Normal Play – Karaoke Switch: This switch is to use switch between normal play and karaoke mode. But still, Output from external Mic can be add in final output.
• Signal vs. Time Chart: This chart shown plot of final output magnitude against time.
• Left Right Balance Slides: This control is to balance left and right input in order to cancel common vocal component.
• Power vs. Frequency: This indicator shows magnitude of each frequency in the final output.
• Stop switch: The program should be terminated using this switch.

10 Steps to Use Karaoke VI
Before running down the steps, make sure all NI LabVIEW and myDAQ drivers are installed in your computer. Then, follow steps given below to run the Karaoke VI.

1. Download the ENGR190_VIs.zip from following link.  
   [http://www.clemson.edu/ces/departments/ece/document_resource/undergrad/electronics/ENGR190_VIs.zip](http://www.clemson.edu/ces/departments/ece/document_resource/undergrad/electronics/ENGR190_VIs.zip)
2. Unzip the above file and locate Karaoke myDAQ for ENGR190.vi.
3. Plug in myDAQ on a USB port and wait to open NI ELVISmx.
4. Now open the myDAQ for ENGR190.vi file.
5. Also plug in a microphone in microphone jack of your computer.
6. Plug in speakers on Audio Out port of the myDAQ.
7. Connect active music source into Audio In of myDAQ.
8. Now, you are almost there. Run the Karaoke myDAQ for ENGR190.vi and place switch in NORMAL PLAY side. You will hear normal music with vocal on the speakers.
9. Try adding your voice in current settings by saying “Go Tigers” on the Mic.
10. Now switch to Karaoke mode and you are ready to become Singer.

**Karaoke VI Block Diagram**

![Karaoke VI Block Diagram](image-url)
Karaoke Circuit Building Instructions

Background
Most popular and rock music recordings use multiple microphones and mixers to generate the left and right signals. Listening in stereo gives a broad presence to the music. Adding these signals together affects the volume but not the musical content. On the other hand, subtracting the signals removes the vocals. The vocals are considered most important, and these are often recorded identically on both left and right channels. The background music due to the stereo mixing has no phase (time) relationship between the channels. If you subtract the channels (which can be accomplished by inverting one signal and then adding them together), the vocal signals are cancelled. This procedure often has the most profound effect on the lead singer and not the background vocals or instruments. (Source: https://decibel.ni.com/content/docs/DOC-17158)

Required Components
- Equipments
  a. myDAQ
  b. LabVIEW installed computer
  c. 3.5mm sub-miniature stereo cable
  d. Music source (e.g. computer)
  e. Speakers
  f. Electret Microphone (e.g. headset)
- Electronic Components for the circuit
  a. Five 741 operational amplifier
  b. One resistance trim pot 20 KΩ
  c. One resistance trim pot 100 KΩ
  d. Resistors: Two 100 KΩ, Eleven 10 KΩ, One 1 KΩ
  e. Capacitors: Four 10 µF, One 4.7µF, One 0.1 µF
  f. Three 3.5 mm sub-miniature stereo socket
  g. One breadboard
  h. Connecting wires

Karaoke Circuit Block Diagram
In order to simplify the project, we will complete it in two stages. In the first stage of the project, we will build the part of circuit which removes vocal component. A stereo music source outputs two signals known as Left channel and Right channel which are used as input to Karaoke circuit as shown in Fig. 01. Each channel is passed through its corresponding amplifier circuit. It is worth noting that the right channel is inverted and amplified while the left channel is only amplified. Next, these two amplified inverted (Right) and non-inverted (Left) channels are added in Adder amplifier to remove common vocal component. Now, output of the stage one has only music (instrumental part) of the song with we
started. In stage 2, we will add our voice with the music to complete the Karaoke circuit. A simple Mic (or Electret Mic) from any headset can be used to input voice. Since the output of Mic is very weak signal, we will need to amplify it before adding to the output of stage one. After amplifying Mic input, it can be added with stage one output signal in Unity Gain Final Adder Amp. We will need to also connect a speaker to the output of Unity Gain Final Adder Amp. Now, we are ready to play the song with new voice.

*Note: How well the karaoke circuit works depends in large part on the recording method in the production of the CD tracks. Some songs will work better than others.*

*Note about Schematic Drawings: All schematic drawings in this tutorial are drawn using Scheme-it® online schematic drawing tool from Digi-Key®.*
Building the Right Channel Inverting Amplifier

**Source:** [https://decibel.ni.com/content/docs/DOC-17158](https://decibel.ni.com/content/docs/DOC-17158)

Assemble the circuit components. Measure and record all the resistors using the DMM. Build the circuit in Fig. 02 for the right-channel preamplifier.
The circuit gain is \((R_f/R_1)\), where \(R_f\) is the feedback resistor (100 KΩ), and \(R_1\) is the input resistor (10 KΩ). The Op Amp requires a +15 V and –15 V power source. The myDAQ have sources available on sockets (+15 V, –15 V, and AGND). Connect the FGEN output (AO 0 on myDAQ) to the point R. Set the FGEN to a frequency of 1000 Hz and amplitude of 0.5 Vpp. Use the Scope to verify the circuit operation with the following settings:

- **Channel 0 Source AI 0**, 100 mV/div connected to Op Amp input
- **Channel 1 Source AI 1**, 1 V/div connected to Op Amp output
- **AI 0- and AI 1- connected to AGND**
- **Time base 1 ms**
- **Triggering Edge Channel 0**

Run continuously both the FGEN and Scope. Use the vertical position dials to verify that the input and the output signals are out of phase (180 degrees) and the gain is close to the resistance ratio (10).

**Building the Left Channel Non-Inverting Amplifier**

**Source:** [https://decibel.ni.com/content/docs/DOC-17158](https://decibel.ni.com/content/docs/DOC-17158)

Assemble the components and build the non-inverting Op Amp circuit shown in Fig. 3. The circuit has a gain of \((1+R_f/R_1)\). Here \(R_f\) equals 100 KΩ, and \(R_1\) is set near the center of the 20 KΩ pot, i.e. 10 KΩ. The nominal gain for this circuit is eleven. Connect the FGEN output (AO 0 for the myDAQ) to the point L. Connect the Scope sockets AI 0 and AI 1 to the circuit input and output points. Use the FGEN and the Scope in the same manner as for the right-channel measurements to verify that the Op Amp output is in phase with the input signal and that the gain is approximately eleven.

*Note: The gain is strongly affected by the pot resistance.*
Matching the Input Parameters
Karaoke circuit that removes the vocal component requires the left and right signals be matched in amplitude. A simple method to check the signal levels is to connect the Scope input AI 0 to the output of the right-channel Op Amp (pin 6) and input AI 1 to the output of the left-channel Op Amp, (pin 6). Ensure the FGEN signal goes to both inputs. [Run] the FGEN and Scope with the same settings. Use the vertical position dials to offset the two signals. Now use a small screwdriver to adjust the amplitude of the left channel to match the amplitude of the right channel. You can read the amplitudes off the scope traces or just read the V_{pp} indicators. The left and right signals are now ready for voice removal.

*Note: Be sure to click on the [Display Measurement] boxes.*
Adder Amplifier: Adding the Right and Left Component

Source: [https://decibel.ni.com/content/docs/DOC-17158](https://decibel.ni.com/content/docs/DOC-17158)

To add two analog signals, another Op Amp circuit called an adder (Figure 3) is useful.

Kirchhoff’s second law states that all currents at a nodal point add up to zero. The left and right signals are applied to the two input resistors R1 and R2. These are tied together along with the Op Amp input (pin3) at nodal point Z. Solving the circuit equations yields

\[
V_{out} = - \left( \frac{R_f}{R_1} \right) \left( V_{left} + V_{right} \right)
\]

Fig. 04: Op Amp adder circuit removes vocals from a stereo recording
If one of these circuits is out of phase with the other, then the adder circuit becomes a subtraction circuit—just what we need to complete our Karaoke circuit. Build the Op Amp adder using three 10 k resistors and another Op Amp. To check out its operation, wire up the left and right Op Amp signals to the two adder inputs. Use the Scope to monitor the input signal (AO 0) on channel 0 and the adder output on Channel 1. When the two input signals are balanced, you should see no AC signal (Fig. 05). Adjust the gain on the left channel to see an unbalanced signal.

Fig. 05: Balanced signals (top) and unbalanced signals (bottom) from adder circuit.
Amplifier for Mic Input

Source: part of this circuit is taken from
http://www.johnhenryshammer.com/TEChREF/opAmps/opamps.html

Fig 06: Amplifier for Microphone signal
The circuit shown in Fig. 06 is used to amplify the Mic input using Op Amp. Direct Mic signal without amplification is couple of milli-volts which cannot be added into the stage one output. Assemble the components and build the circuit shown in Fig. 06 without Mic. To test the circuit, Connect the FGEN output (AO 0 on myDAQ) in place of Mic. Set the FGEN to a frequency of 1000 Hz and amplitude of 0.05 Vpp. Use the Scope to verify the circuit operation with the following settings:

Channel 0 Source AI 0, 100 mV/div connected with FGEN AO 0
Channel 1 Source AI 1, 1 V/div connected to Vstage2 output
AI 0- and AI 1- connected to AGND
Time base 1 ms
Triggering Edge Channel 0

Run continuously both the FGEN and Scope. Use the vertical position dials to verify that Vstage2 output signal is about 1.5 Vpp. If Vstage2 signal is not about 1.5 Vpp, use a screwdriver to adjust 100 KΩ pot to achieve desired output. Here, the 100 KΩ pot is being used as gain controller, you may have higher gain if your need more amplification for your Mic signal.

**Unity Gain Final Adder Amplifier**


Figure 07 shows a mixer that combines the stage one and amplified Mic signals connected on R1 and R2 respectively. Build the circuit using components and connect it to the Vstage1 and Vstage2.

Unity Gain Final Adder Amp.

![Unity Gain Final Adder Amplifier Circuit](image)

Fig. 07: Unity gain final adder amplifier circuit

Great! We are almost ready for the iPod.
Completing the Karaoke Circuit

Source: [https://decibel.ni.com/content/docs/DOC-17158](https://decibel.ni.com/content/docs/DOC-17158)

Although our test signals have been AC, they have been directly coupled to our circuit. Now we will remove any DC signals from the input signal sources by adding a 10 μF capacitor and a 10 KΩ resistor to each channel (Fig. 08). A similar circuit is added to the output of above circuit.

![Decoupling circuit additions for left (Vleft), right (Vright) inputs and output (Vout)](image)

Fig. 08: Decoupling circuit additions for left (Vleft), right (Vright) inputs and output (Vout)

Now with the stereo plug and sockets, we are ready to fly. Connect up the iPod music source and speakers. The music source (Audio In) is connected through the stereo cable to the stereo socket, which is then divided into left and right wires. Power up your circuit. Amazing!

*Note: How well the karaoke circuit works depends in large part on the recording method in the production of the CD tracks. Some songs will work better than others.*
**Record a PowerPoint Slide Show (Office 2010)**

PowerPoint allows you to easily record timing and narration for a slide show. You simply click “Record Slide Show” and then start talking (assuming your computer has a microphone). The timing of when you advance slides will also be recorded.

**Instructions**

From the “Slide Show” menu, select “Record Slide Show.” You can choose to either start recording from the beginning of the presentation or at the current slide.

![Slide Show Toolbar](image)

This should bring up the full screen slide show view along with a small window in the top left corner of the screen.

![Recording Window](image)

This window controls the recording. The arrow button on the left advances to the next slide, the pause button pauses recording, and the U turn discards the recording for the current slide and starts it over. The time on the left is the time recorded for the current slide and the time on the right is for the entire presentation.

When you are finished recording your presentation, close the recording window and exit the slide show. You can review what you’ve recorded by playing the slide show from the “Slide Show” toolbar.

![Play Slideshow](image)
You can also have your mouse pointer show up in the recorded slide show by holding both the CTRL key and the left mouse button while moving the mouse around. The pointer will be displayed as a “laser pointer.”

After recording a slide, in the left column of the “Normal” view, there will appear a star icon under the slide number and an audio icon in the bottom right corner of the slide to indicate that the slide has a transition and narration set.

The audio icon also appears in the bottom right corner of the slide itself in “Normal” view.

You can mouse over this to play the narration or adjust its volume. Also, you can select the icon and delete it to remove the narration and timing from that slide.
**Microphone Settings (Windows 7)**

To adjust the volume on your microphone, open the Control Panel. Click on “Hardware and Sound” and then click on “Sound.”

![Hardware and Sound](image)

In the window that opens, select the “Recording” tab.

![Sound](image)

Select your microphone device, and click the “Properties” button. In the window that opens, select the “Levels” tab. From here, you can adjust the microphone volume and boost.

![Microphone Properties](image)
Export to Video

After you have recorded all your narration, you can convert your PowerPoint presentation to a video. In PowerPoint, open the “File” menu and select “Save & Send.” Under “File Types,” select “Create a Video.” In the options on the right side of the screen, select “Internet & DVD” and “Use Recorded Timings and Narrations.” When you are ready to start, click “Create Video.” This process can take several minutes, depending on the length of your presentation and the size of embedded videos and narration.

You will be prompted for a location to save the video. This will create a Windows Media Video (.wmv) file, which is playable in Windows Media Player.