12 Channel Vocoder

UAH Spring 2025 ECE Senior Design Project

Project Overview

When we speak our voice carries several different frequency components. We have the main carrier portion as well as formants which allow us to speak at the same tone but still be able to distinguish words and letters from one another.

The goal of this project is to filter an incoming voice and capture the formants and force those formants onto a different carrier signal which is usually a synth signal such as a square wave. In effect the vocoder makes one's voice have a robotic undertone. Our vocoder is 12 channels which is just the number of filters we are using to perform the task. More filters will make the output more clear. For an example listen to Mr. Blue Sky by Jeff Lynne around the 2 minute 20 second mark.

The kit

We used a kit from Music From Outer Space. Ray Wilson, the creator of the website, designed this kit and provided us with very in depth instructions for building it and tuning it. The kit included the PCB and almost every circuit element we needed. On top of the kit we had to buy the power supplies and make the case and front plate.

This project is completely analog and requires no software to work. The vocoder performs, in real time, signal filtering, wave rectification, and amplitude modulation.

External requirements include a microphone or pre-recorded voice audio, a speaker, a pre-amp for the microphone if used, and an optional external synth signal if you opt to not use the internal square wave.

Team Vocoder

The team is composed of Dustin Dodd (Team Lead), James Brewington (Circuit Testing Lead), and Joe McInvale (Circuit Analysis Lead). Our faculty advisor is Dr. Aubrey Beal who aided with access to his lab and technical expertise on electronics and music. All group members were interested in this project because we all have a background in music and we all are Electrical Engineers.