Chapter 7  PROGRAMMING EXERCISE

Creating a Vocoder in C++

A vocoder (voice encoder) is a device that was originally developed for low bandwidth transmission of voice messages but is now used for special voice effects in music production.

The original idea behind the vocoder was to encode the essence of the human voice by extracting just the most basic elements – the consonant sounds made by the vocal chords and the vowel sounds made by the modulating effect of the mouth. The consonants serve as the carrier signal and the vowels (also called formants) serve as the modulator signal. By focusing on the most important elements of speech necessary for understanding, the vocoder encoded speech efficiently, yielding a low bandwidth for transmission. The resulting voice heard at the other end of the transmission did not have the complex frequency components of a real human voice, but enough information was there for the words to be understandable.

Today’s vocoders, used in popular music, combine voice and instruments to make the instrument sound as if it’s speaking, or conversely, to make a voice have a robotic or “techno” sound. The concept is still the same, however. Harmonically-rich instrumental music serves as the carrier and a singer’s voice serves as the modulator.

The implementation of a vocoder is diagrammed in Figure 1. Both the carrier and modulator signals are sent through bandpass filters. These filters divide the carrier and modulator into frequency bands. Then envelope followers from the modulator are imposed on the carrier to shape the carrier wave’s frequency components over time.

Your assignment is to see if you can figure out the mathematics that would make this happen and implement a vocoder in a C++ program. You may want to do some further research into vocoders. You should be able to find some examples of vocoded voices online. Also, your digital editing software may have vocoder effects, so you can compare your results with those produced by professional software. (Both Logic and Audition have vocoder effects.)
Figure 1 Vocoder