

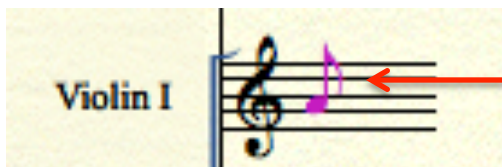
The Use of Harmonics in “Las Flores del Encino”

On the summer of 2013, I had the privilege and chance to travel to Siena, Italy, and study composition with professor Dimitris Andrikopolous. Dimitris was born in Greece where he studied viola. Later, he studied composition in the Netherlands with K. De Vries. He is currently head of the Master’s program in ESMAE, the Polytechnic of Portugal. While studying with Dimitris I was introduced to the use of harmonics in strings.

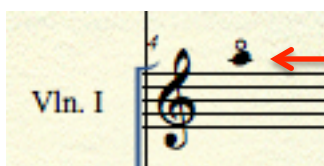
To understand properly what a harmonic is, it is important to understand the concept of an overtone. An overtone is any frequency above the fundamental frequency. What does this mean? When you play a note in the piano or the guitar that note has a specific frequency E.g. 100. But what you hear is not only the frequency at 100 (the fundamental), you also hear frequencies above that frequency itself. The combination of the fundamental frequency and the various overtones is what give the note you are playing its specific sound or timbre. Samuel Adler in the *Study of Orchestration* explains how with strings “Every pitch produced on [a string] is a combination of the open string, called the fundamental or first harmonic (or first partial), and some overtones (second partial and higher) (P.42).”

A harmonic is a type of overtone that is an integer multiple of the fundamental itself. What does this mean? Imagine fundamental note (f) has a frequency of 100. The first harmonic overtone ($2f$) will have a frequency of 200, and the one above that ($3f$) will have a frequency of 300. All of these harmonic overtones are present in the note we play, and they can be isolated from the string instruments by pressing the string lightly at different points instead of pressing it all the way down in the fingerboard. Want to try it out? If you have a guitar place your finger over the fifth fret and lightly press the top string (E string) without going all the way down. The note you will produce is the third harmonic, which is one octave and a fifth up from the fundamental E string you first played, in this case the note is the B above middle C.

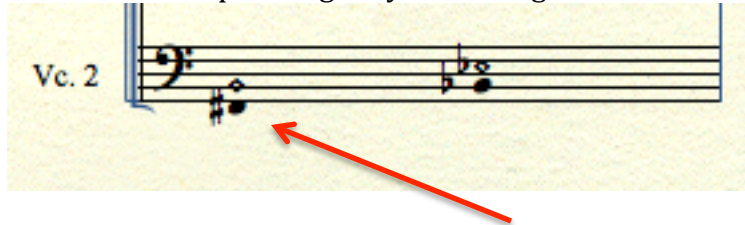
Here is an example of how we notate a harmonic in music. In this case the instrument playing the note is a Violin. Open string II in the violin is an A with a frequency of 440Hz.



The first harmonic of that A, which is an octave above, would have a frequency of 880Hz and would be notated by writing the A one octave up and drawing a circle above it



Because there are only a limited number of integer multiples above the fundamental open string, not all harmonics can be produced naturally. However, we can produce artificial harmonics to get notes that do not belong to the natural harmonic series of a string. To get an artificial harmonic we press the note we want to hear as a harmonic in the fingerboard and at the same time we touch a perfect fourth (5 semitones) above that note. The note produced is the harmonic 2 octaves above the note we are pressing fully in the fingerboard.



F# does not belong to the natural harmonic series of the Cello, so we write the F# with a diamond located a perfect 4th above. The note produced is an F# two octaves above the written one.

Now that you roughly understand harmonics, you can understand how most of the sounds in "Las Flores del Encino," one of my compositions from Siena were produced. Listen to the music. You will hear a piano, two voices, and very thin pitches floating around in the air. These pitches are harmonics. Below, you will find the first 7 measures of the piece. Look out for the natural and artificial harmonics in the strings. Note that this piece has no written tempo, the players can choose to play any note from the measure given moment, and the conductor indicates the change of measure by signalling the number in the top left corner of each measure. A good guide is the piano, you will clearly notice when the piano notes change indicating a change of measure.

-- *Cristóbal Martínez Yanes*