Thinking through the guitar : the sound-cell-texture chain

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Chapter 6 Harmonics

Contents

Chapter 6 Harmonics

Harmonics[37] emerge when the string is plucked and simultaneously touched at a nodal point, creating an overtone. This chapter shows ways in which the composer can handle the characteristics of harmonics, use them to build horizontal as well as vertical cells, and finally, how these cells can be creatively combined to form musical textures playable on the guitar.

6.1 Sound

6.1.1 Pitch range

Figure 6.1 Guitar harmonics range

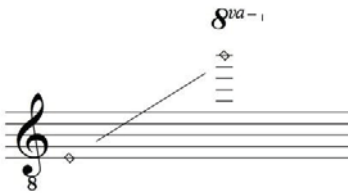
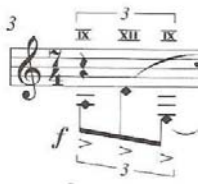


Figure 6.1 lists the range of harmonics available on the guitar, including both natural and artificial harmonics. Higher harmonics are playable, but are hardly audible without amplification. Harmonics are performed in various ways, depending on the type of harmonic (see section 6.1.2).

The notation of harmonics has often been the source of confusion, because of the widely divergent notations used by composers when writing for the guitar. Not only guitar scores suffer from inconsistencies in the notation of harmonics; it is a general problem in contemporary music, particularly for bowed instruments (Warfield, 1973-1974).

Figure 6.2 Action notation of harmonics



(SONATA, BROUWER)

[37] The term “harmonics” is preferred here over “harmonic sounds”, in order to avoid confusion with the musical concept of harmony that the latter term may cause.

The confusion surrounding the notation of guitar harmonics is brought about by the fact that some composers use some type of action notation (for instance in Figure 6.2, which does not indicate the sounding pitches), notating the action that has to be performed to bring about a harmonic, while other composers use result notation, notating the desired resulting pitch of the harmonic (Figure 6.1). A solution to this issue is to always indicate the sounding pitch of the harmonic. An emphasis on pitch accuracy makes for a concise and unequivocal stream of information toward the performer (Kachian, 2006, p. 53). A correct notation of pitches allows the performer to, first, understand the pitch materials provided by the composer and, second, search for a method of producing these pitches in the form of harmonics. Using a legend to give an overview of the harmonics used as well as their notation is a way to facilitate correct interpretation by the guitarist.

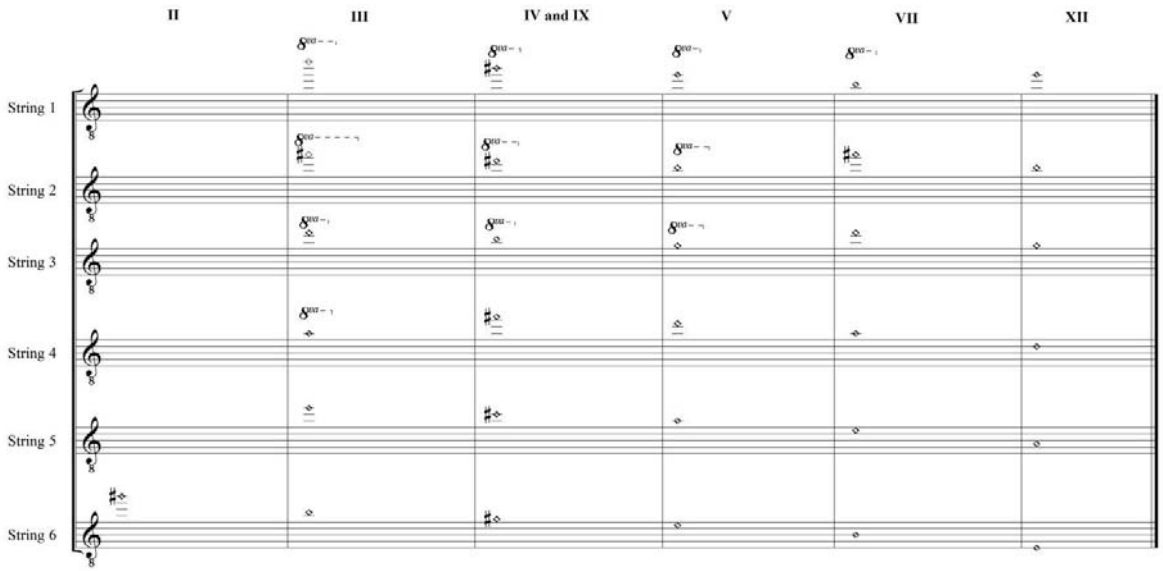
A clear method of notating harmonics is to use diamond shaped noteheads and to display the sounding pitch, as in Figure 6.1. If a specific fingering is desired for the harmonic, this can be indicated with the use of string numbers (string number in a circle), finger indications (a letter for the right hand, a number for the left hand) and position indications (Roman numerals). Non-standard artificial harmonics should be notated by showing the fingered note as well as the pitch of the position where the string should be lightly touched in parentheses. This is in accordance with the suggestion Gould makes for the notation of such harmonics in her work on music notation (Gould, 2011, p. 388).

6.1.2 Types of harmonics

There are two types of harmonics on the guitar: natural harmonics and artificial harmonics.

Natural harmonics

Figure 6.3 Overview of natural harmonics[38]



[38] For the use of Roman numerals in this example: see *Reading Guide.*

Natural harmonics are found at nodal points on the open strings. The performance of a natural harmonic is as follows; first, the nodal point is lightly touched with a finger of the left or right hand. The string is then plucked with a finger of the right hand while the nodal point is still lightly touched. At this point, the overtone sounds. Immediately after the overtone starts to sound, the finger that lightly touches the nodal point is immediately lifted from the string in order not to damp the vibrations. Natural harmonics generally have longer resonance than artificial harmonics because they are produced on an open string. The most commonly used natural harmonics are those in positions V, VII and XII. Harmonics in positions II and III are hardly audible or not audible on the nylon strings. The harmonics in positions V and XII are the only harmonics that are "perfectly in tune" (Kachian, 2006, p. 54). For a chart of the fingerings of natural harmonics, see Appendix B.

Artificial harmonics

Artificial harmonics are created by stopping[39] a note and lightly touching the nodal point that is found by moving the nodal point up in accordance with the distance between the stopped note and the open string. The guitarist performs artificial harmonics by stopping a note with a finger of the left hand, lightly touching the nodal point with a finger of the right hand and plucking the string with a finger of the right hand. Immediately after the sounding of the overtone, the finger that lightly touches the string leaves the string in order not to damp the vibrations. Artificial harmonics cover the full range of the harmonics range pictured in Figure 6.1, except for the low e, which can only be produced as a natural harmonic.

Figure 6.4 Artificial octave harmonic

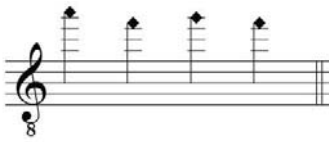
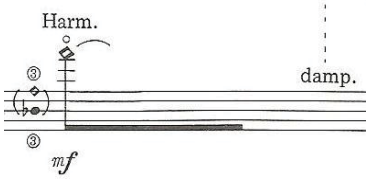


Figure 6.5 Artificial octave+fifth harmonic

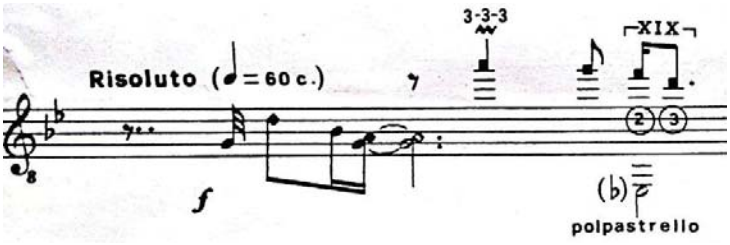


(TOWARD THE SEA, TAKEMITSU)

The most common type of artificial harmonic is the octave harmonic (Figure 6.4). The harmonics pictured in Figure 6.4 are produced by stopping the pitches one octave below the sounding harmonics with the left hand, while lightly touching the pitches twelve frets higher and plucking them, thus causing the harmonics to sound an octave higher than their stopping position. In the notation of artificial non-octave harmonics, the composer should ideally show the fingered note and the pitch of the position between brackets (Figure 6.5).

[39] On string instruments, "stopping" refers to pressing down the string on the fingerboard to produce a desired pitch (Free Dictionary by Farlex, 2013).

Figure 6.6 Harmonics notation



(DUE CANZONI LIDIE, D'ANGELO)

D'Angelo makes a practical distinction between the notation of natural and artificial harmonics by using diamond shaped noteheads for natural harmonics and rhomboid shaped noteheads for artificial harmonics, both at their sounding pitch. This notation is particularly useful when many different types of harmonics are used in a composition.

6.1.3 Timbre possibilities

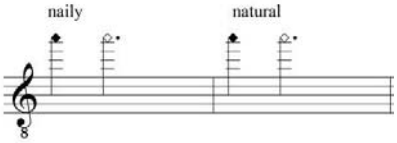
Attack

When a natural harmonic is touched lightly with the left hand and plucked with the right hand, it can be plucked with either the apoyando or tirando attack. Just as is the case with regular plucked notes, the apoyando has a more projecting sound than the tirando. Artificial harmonics and natural harmonics that are lightly touched with the right hand instead of the left hand are typically plucked with the tirando attack. This is because it is awkward for the performer to execute an apoyando attack with a finger of the right hand while another finger of the right hand touches the string and subsequently leaves the string. The prescription of an apoyando or tirando attack for a harmonic is achieved through the use of a symbol that is specified in a legend, or with a verbal instruction in the score (see section 5.1.2 under "Attack").

Sound color and playing position indications

It is possible to assign a sound color to natural harmonics; the performer can then find a way to play the harmonic in a manner consistent with the indication in the score.

Figure 6.7 Artificial harmonics sound color

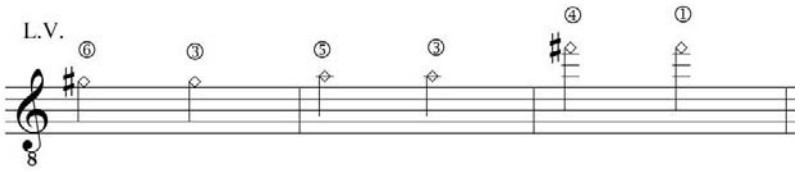


The sound color of artificial harmonics can only slightly be changed, because of the limitations to different plucking angles and positions the technique of producing harmonics poses. However, it is possible to prescribe a more “naily” sound for an artificial harmonic, or a more “natural” sound with a verbal instruction (Figure 6.7).

The playing position for natural harmonics can be changed; it is possible to assign playing positions ranging from ponticello to tasto. The playing position of artificial harmonics cannot be altered; the light touching and plucking are performed with the same hand, which confines the plucking finger to a position close to the nodal point.

Fingering

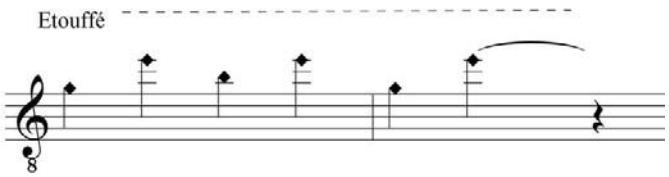
Figure 6.8 Harmonics fingerings[40]



The fingering of a harmonic influences its sound. Differences in sound can particularly be appreciated when one compares a harmonic plucked on a metal-wound string versus a nylon string (Figure 6.8)

Etouffé

Figure 6.9 Harmonics etouffé

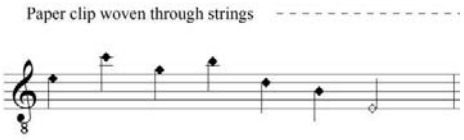


The timbre of harmonics can be changed by muffling (Figure 6.9). Etouffé harmonics are performed by plucking a note and simultaneously slightly damping it with the side of the right hand. Because the right hand is involved in damping the notes, etouffé writing for harmonics is most effective for single line writing, and for natural harmonics. Sounds scored etouffé have a reduced dynamic range and resonance.

[40] For the use of circled numbers in this example: see *Reading Guide*. In this example, each measure contains two instances of the same note; string indications refer to the string on which the notes are to be played.

Prepared guitar

Figure 6.10 Paper clip preparation



When the guitar is prepared with an object, such as in Figure 6.10, the timbre of harmonics is affected. As a result of weaving a paper clip through the strings, the harmonic takes on a gamelan-like timbre. When the paper clip is lightly woven through the strings, as in the video example of Figure 6.10, the duration of the resonance is close to that of the resonance of a normal harmonic. When, on the other hand, the paper clip is woven tightly around the strings, it restricts the space for string vibration and consequently shortens the resonance time.

6.1.4 Dynamic range

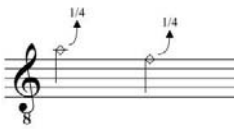
Due to the characteristics of their production, through light nodal touching and plucking, harmonics have a more limited dynamic reach when compared to regular plucked notes. Harmonics sound particularly well in the *pp-mp* dynamic range. Octave harmonics are the lowest pitched harmonics and are relatively the loudest, while the dynamic range of harmonics becomes smaller when their pitch is higher. Harmonics in the highest pitch range have a small dynamic range around *pp*, particularly in the highest octave.

6.1.5 Vibrato

All artificial harmonics can be performed with vertical or lateral vibrato because they are stopped with a finger of the left hand. The same types of vibratos that are possible for regular plucked notes can also be used for artificial harmonics. Natural harmonics are not stopped with a finger of the left hand; vibrato is therefore not possible for such notes.

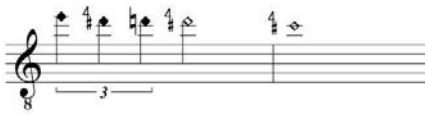
6.1.6 Pitch bends and microtones

Figure 6.11 Harmonics bend



The pitch of an artificial harmonic can be bent up (Figure 6.11) in the same way a regular plucked note can be.

Figure 6.12 Harmonics quarter tones



Microtones of harmonics can be created either by using a microtonal scordatura (see Appendix D) or by using a pitch bend (Figure 6.12). In contrast to bowed strings instruments without frets, the guitar cannot produce microtones by finger placement on the fingerboard, but only by bending the string out of its regular tuning, and this also true for harmonics. This means that for each harmonic microtone, the guitarist needs a short moment the bend the string before the microtone can be produced.

6.2 Vertical cells

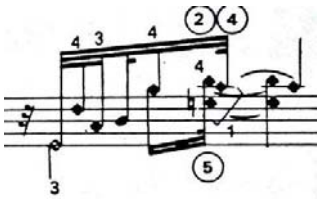
When creating vertical combinations of harmonics, up to six harmonics can be produced simultaneously. In order to see which notes may be combined, Appendix B should be consulted. Harmonics can be combined on adjacent and non-adjacent strings.

6.2.1 Harmonics combinations

Figure 6.13 Vertical harmonics cell

(SEQUENZA XI, BERIO)

Figure 6.14 Vertical harmonics cell



(DUE CANZONI LIDIE, D'ANGELO)

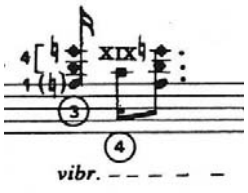
When writing vertical combinations containing many natural harmonics, the most effective combinations consist of harmonics in the same position (Figure 6.13). For vertical combinations of harmonics, the natural harmonics found in positions V, VII and XII are much more sonorous than those found in other positions. When scoring smaller combinations of two or three notes, the natural harmonics from nearby positions can be combined, for instance from position V and VII, or position VII and XII (Figure 6.14). In all

of these cases, the guitarist uses the left hand to touch the nodal points and the right hand to pluck the strings.

Artificial harmonics can only be combined vertically in an arpeggiated manner; they are therefore discussed in the horizontal cell section.

6.2.2 Combinations of harmonics and regular plucked sounds

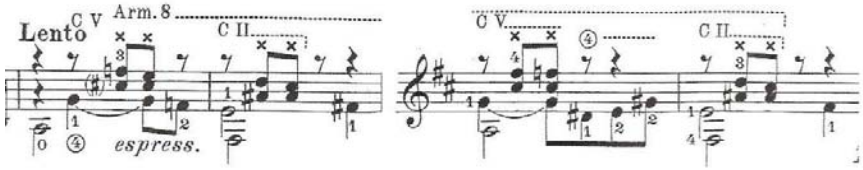
Figure 6.15 Harmonics in position XII and regular note



(DUE CANZONI LIDIE, D'ANGELO)

Both natural and artificial harmonics can be combined with regular plucked sounds. When scoring a vertical cell of natural harmonics and regular plucked sounds, the most effective combinations consist of up to three harmonics and one regular note. For such combinations, natural harmonics in position XII work best because of their more sonorous character (Figure 6.15).

Figure 6.16 Harmonics combined with regular notes[41]



(SONATA III, PONCE)

When scoring combinations of non-12th position natural harmonics and regular plucked sounds, or of artificial harmonics and regular plucked sounds, effective combinations are composed of a regular note and not more than one harmonic. In these cases, the guitarist uses the right hand to pluck the string and touch the nodal point, or uses the left hand to touch the nodal point and the right hand to pluck the string.

[41] Ponce uses crosses and the indication "Arm. 8" to indicate that octave harmonics should be played. This notation can be confusing for the performer. Therefore, the composer should notate the sounding pitch instead, and use diamond shaped noteheads to signal that the note is a harmonic (see section 6.1.1).

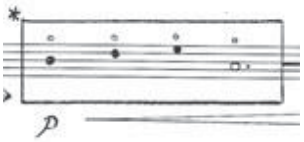
6.3 Horizontal cells

In this section, the various horizontal cells that can be created with harmonics are discussed. Because harmonics are typically scored in combination with regular plucked notes, special attention is given to combinations of these two sound categories.

6.3.1 Single lines

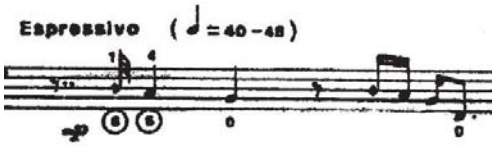
Design

Figure 6.17 Single line harmonics



(So-Ri, Oh)

Figure 6.18 Regular notes and harmonics



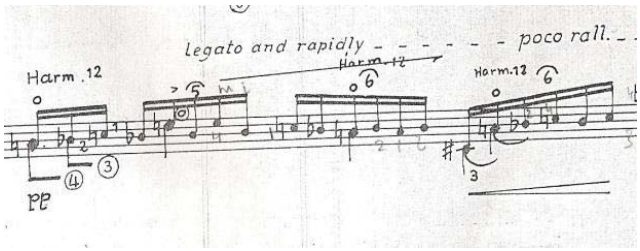
(Due Canzoni Lidie, D' Angelo)

Single line horizontal cells of harmonics can consist of harmonics alone (Figure 6.17) or of a horizontal combination of harmonics with other sounds. A common horizontal combination of sounds is that of harmonics and regular plucked notes (Figure 6.18).

Resonance

Single line horizontal cells of harmonics can be scored either with or without resonance. The first option is for such cells to be made to sound in a way that the notes **do not** ring on into the temporal space of subsequent notes. This is possible when the line is scored at a slow speed, when the intervals are relatively small, when both conditions are fulfilled, or when a staccato articulation is used. Artificial harmonics work particularly well for such lines, because their resonance stops as soon as the stopping finger is lifted, so that no additional damping action has to be performed with the right hand.

Figure 6.19 Single line scoring with resonating harmonics



(Folios, Takemitsu)

In contrast, single lines containing harmonics can also be made to sound in such a way that notes **do** ring on into the temporal space of subsequent notes. This kind of scoring works particularly well for natural harmonics, as they have better resonance. Moreover, it is not necessary for a finger of the left hand to continue stopping a string for it to resonate. This type of scoring is encountered in many 20th century works (Figure 6.17, Figure 6.18, Figure 6.19).

Harmonic possibilities

The pitch choice possibilities are very wide when writing single line horizontal cells containing harmonics, because the performer only has to be concerned with playing one line. The availability of many pitches as natural harmonics (Figure 6.3) makes it possible for the performer to connect the various notes in a horizontal cell of regular plucked sounds more easily in a legato way when one or more regular plucked notes are scored as harmonics instead.

Speed

Figure 6.20 Rapid single line passage containing natural harmonics

(DUE CANZONI LIDIE, D'ANGELO)

The speed at which a single line horizontal cell containing harmonics can be scored depends on the type of harmonics used. If natural harmonics are used, the line can be scored at high speeds, especially when it is scored over multiple strings (Figure 6.20). Single lines containing artificial harmonics can only be scored at slow or moderate speeds, because each repeated artificial harmonic is plucked with the same finger of the right hand, thus limiting speed.

Articulation

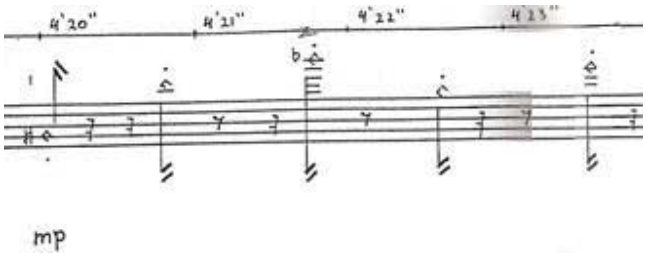
Single lines containing harmonics can be scored with a variety of articulations, such as legato, accents, staccato and glissando.

Legato

The performer can ensure that transitions between notes are performed in a legato manner by avoiding premature decay of notes and avoiding interruptions caused by placing attacking fingers on resonating strings. The composer should use phrase marks to indicate that a passage is to be played in this manner.

Staccato

Figure 6.21 Staccato harmonics

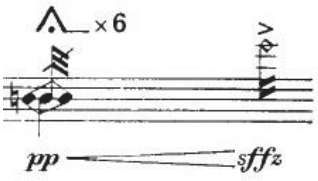


(AUBURN, V/D AA)

Single lines containing harmonics can be scored staccato (Figure 6.21). The staccato is performed by lifting the finger of the left hand immediately after stopping the string in the case of artificial harmonics, or by damping the string with the right or left hand in the case of natural harmonics. Staccato is prescribed with a staccato mark attached to the note.

Accents

Figure 6.22 Harmonics accent[42]

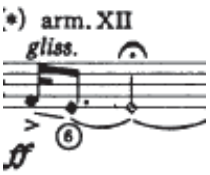


(SEQUENZA XI, BERIO)

Despite of the limited dynamic range of harmonics, it is possible to score accents for harmonics. Such accents are particularly effective when scored at a very resonant nodal point, such as the nodal point in position XII (Figure 6.22). An accent is prescribed with an accent mark attached to the note.

Glissando

Figure 6.23 Tuning key harmonics glissando



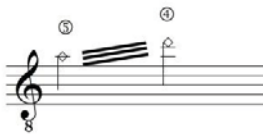
[42] In the *Sequenza XI*, Berio uses open diamond shaped noteheads to notate harmonics, even for eighth notes and sixteenth notes. This can lead to confusion concerning the note values of the harmonics. For harmonics shorter than a half note, closed noteheads should be used.

(PAIASAJE CUBANA CON CAMPANAS, BROUWER)

Although not used very often, glissandi can be used to create an upward or downward travelling pitch of a harmonic. Horizontal cells of harmonics can be scored with literal glissando, partial glissando, simultaneous glissando and plucking, and tuning key glissando. Tuning key glissandos can be scored with artificial or natural harmonics (Figure 6.23). In this example, the sixth string is tuned to f, and the initial note is played as a natural harmonic in position XII. After the sounding of the harmonic, a sounding f, it is tuned down to e with a tuning key glissando. Non-tuning key glissandos are only possible for artificial harmonics. Since slurs are not available for harmonics, harmonics glissandi may be used as an alternative. The glissando is prescribed with a line connecting the notes in question.

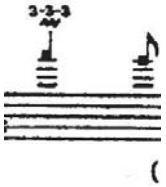
Embellishment

Figure 6.24 Natural harmonics trill



Embellishments of harmonics can be prescribed by scoring natural harmonics over two adjacent strings, for instance as a trill (Figure 6.24). The continuous positioning of the fingers on the nodal point diminishes some of the resonance of the harmonic, as the finger that lightly touches the string is normally, and ideally, immediately lifted after the note has been plucked. For this reason, natural harmonics that are part of a trill are ideally located on nodal point in position V, VII or XII, being the most resonant nodal points. Trills over a regular plucked note and a natural harmonic are also possible when scored over adjacent strings; in this case the regular plucked note will sound louder than the harmonic.

Figure 6.25 Glissando trill

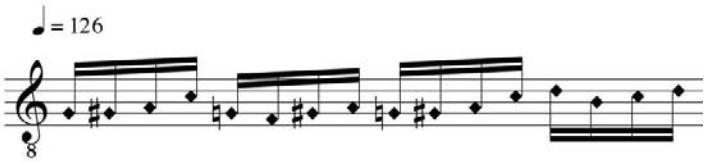


(DUE CANZONI LIDIE, D'ANGELO)

The other possibility is to use glissando to create embellishments, for instance by creating a trill with the help of an ascending and descending glissando, as on the first note in Figure 6.25.

Non-functional writing

Figure 6.26 Non-functional single-line writing



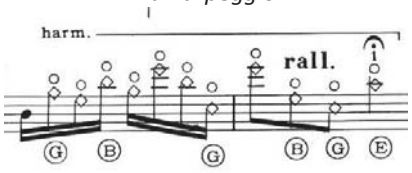
Examples of non-functional writing of single lines of harmonics:

- Rapid successions of artificial harmonics (Figure 6.26)
- Legato phrasing on notes that lie outside the hand span
- Rapid succession of notes that lie outside the hand span

6.3.2 Arpeggio

Design

Figure 6.27 Harmonics sequence in an arpeggio[43]

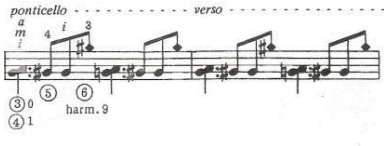


(ETUDE 1, VILLA-LOBOS)

Figure 6.28 Arpeggio containing multiple harmonics

(FIVE BAGATELLES, WALTON)

Figure 6.29 Arpeggio containing one harmonic



(SONATA, GINASTERA)

It is possible to include harmonics in an arpeggio; the arpeggio can contain a sequence of only harmonics (Figure 6.27), multiple harmonics as well as regular plucked notes (Figure 6.28), or one harmonic in the midst of regular plucked notes (Figure 6.29). For all of these arpeggios containing harmonics, natural harmonics are most effective, as they allow the right hand to execute the arpeggio in the same way as when the hand executes arpeggios of regular plucked notes. Arpeggios of artificial harmonics are also possible, but less common due to the slow maximum speed of such arpeggios.

Resonance

A characteristic feature of arpeggio horizontal cells containing harmonics is that most notes ring on beyond their notated value, unless it is explicitly specified that they should be damped after their notated value, or if the resonance of a string ends because it is damped as the result of the fingering. As

[43] In this example, Villa-Lobos uses the antiquated practice of indicating strings with circled pitch names instead of string numbers. In addition, the harmonics are not notated at their sounding pitch, which can be confusing for the performer.

is the case with arpeggios of regular plucked notes, it is not necessary and even impractical to notate the exact note duration for each note.

Harmonic possibilities

The harmonic possibilities of arpeggio horizontal cells containing natural harmonics are limited to the available natural harmonic pitches and the regular notes within the hand span around the nodal points of natural harmonic. The harmonic possibilities of arpeggios containing artificial harmonics are much broader: the full range of harmonics can be used, as long as they fit within the hand span of the left hand.

Speed

Arpeggios of natural harmonics can be performed with considerable speed (Figure 6.28). Arpeggios of artificial harmonics can only be performed at slow speeds, as each artificial harmonic is played with the same finger of the right hand and each harmonic requires careful coordination between left and right hand. However, when artificial harmonics in a sequence are all scored in the same fret, they can be performed at the same speed as natural harmonics, as the left hand does not have to reposition during the performance of the artificial harmonics.

Articulation

Arpeggio horizontal cells containing harmonics can be scored with a variety of articulations, such as legato, accents, staccato and glissando.

Legato

Legato is a very natural articulation for arpeggio horizontal cells containing natural harmonics, as natural harmonics usually ring on after their attack. The composer should indicate that a particular arpeggio is to be played legato with a phrase mark (Figure 6.28).

Accents

Accents can be used in arpeggio horizontal cells containing harmonics to bring out a particular note in the arpeggio. To this end, an accent mark should be attached to the note.

Staccato

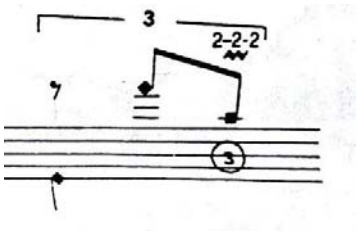
Staccato articulations for arpeggio horizontal cells containing harmonics are particularly effective when scored for alternations of two notes. As is the case with arpeggios of regular plucked notes, staccato in larger arpeggios containing harmonics works well when applied to a small number of notes or at end of a passage; this is because each staccato note requires an additional damping or lifting move of the performer, which is difficult to perform when other notes are simultaneously performed.

Glissando

Glissando articulations to connect notes arpeggio horizontal cells containing harmonics are only possible for artificial harmonics. The composer should use a line between notes to indicate that these notes are to be performed glissando.

Embellishment

Figure 6.30 Embellishment in arpeggio

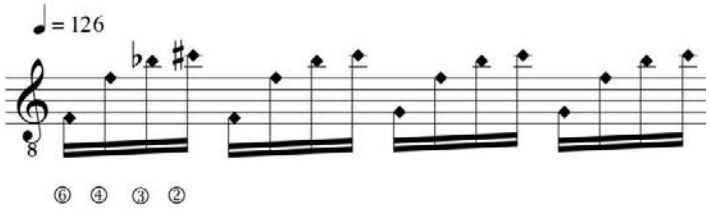


(DUE CANZONI LIDIE, D'ANGELO)

Embellishments in arpeggios containing harmonics can be scored by using trills of natural harmonics over adjacent strings or by using a glissando trill in a slow arpeggio containing artificial harmonics, such as on the last note of Figure 6.30. In this figure, all harmonics are notated as sounding pitches.

Non-functional writing

Figure 6.31 Non-functional writing



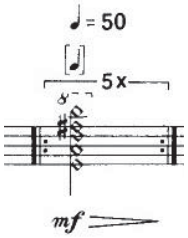
Examples of non-functional writing for arpeggio horizontal cells containing harmonics:

- Rapid arpeggios of artificial harmonics (Figure 6.31)
- Staccato articulation for rapid arpeggios of natural harmonics.

6.3.3 Vertical cell sequences

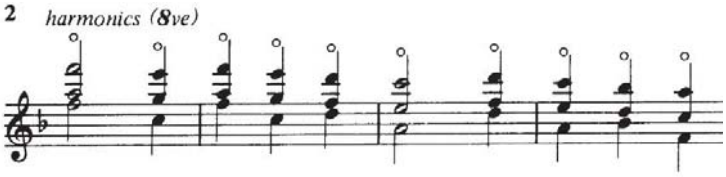
Design

Figure 6.32 Vertical cell sequence of harmonics



(SEQUENZA XI, BERIO)

Figure 6.33 Vertical cell sequence of harmonics and regular plucked notes[44]



(CORDOBA, ALBÉNIZ ARR. WILLIAMS)

Vertical cell sequences containing harmonics can consist of harmonics alone (Figure 6.32), or of harmonics as well as regular plucked notes (Figure 6.33). Vertical cell sequences consisting of harmonics alone are usually comprised of only natural harmonics, while in the case of vertical cell sequences containing harmonics as well as plucked notes, artificial as well as natural harmonics are used.

Resonance

Vertical cell sequences of harmonics usually do not last beyond their initial value, since each time a vertical cell is plucked, one or more strings from the previous attack are damped. Vertical cell sequences containing artificial harmonics have less resonance than those containing natural harmonics.

Harmonic possibilities

The harmonic possibilities of vertical cell sequences consisting of natural harmonics are limited to the vertical combinations possible around the nodal points (see also Appendix B). Harmonic possibilities of vertical cell sequences containing artificial harmonics are not limited by such restrictions: the full regular note and artificial harmonics range can be used.

Speed

Vertical cell sequences consisting of natural harmonics alone can be scored at moderate speeds. Vertical cell sequences containing artificial harmonics can be scored at slow speeds, as each artificial harmonic requires careful coordination by the performer. Artificial harmonics in the highest pitch range particularly impede speed, as there are little visual clues available to the player to ascertain the correctness of the finger touching the nodal point (Figure 6.33; the top notes of the vertical cells in this image are all played as artificial harmonics).

[44] In this example, Albéniz uses circles to indicate harmonics. The use of circles above notes to indicate harmonics is not ideal, as the circles can be confused for open string fingerings. Moreover, it does not become clear in this example whether the circles are intended for all notes of the vertical cell, some notes, or just one.

Articulation

Vertical cell sequences containing harmonics can be provided with a variety of articulations, such as arpeggiated attack, legato, accents, staccato, and glissando.

Arpeggiated attack

Figure 6.34 Arpeggiated chord with harmonic

(SEQUENZA XI, BERIO)

Vertical cells containing harmonics can be arpeggiated in the same way a vertical cell of regular plucked notes is; in upward (Figure 6.34) or downward direction. The composer should provide a wavy line to indicate that an arpeggiated attack is to be used, accompanied by an arrow in the case of a downward arpeggiation.

Legato

Figure 6.35 Legato in vertical cell containing harmonics

(SEQUENZA XI, BERIO)

Vertical cells of natural harmonics can effectively be connected with legato articulation, as such cells give the performer freedom to move along the fretboard without having to stop the string with the left hand, as opposed to vertical cells that contain artificial harmonics. Sequences of different vertical cells containing harmonics that are located close by on the fretboard are easier to perform with legato articulation than vertical cells that are further apart. The composer should use a phrase mark to indicate that vertical cells containing harmonics are to be performed in this manner, as Berio does in Figure 6.35.

Accents

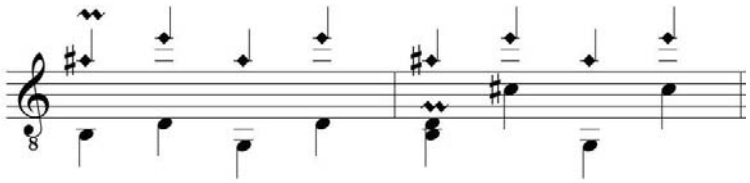
The composer can use accents for vertical cells to make them stand out. When an accent is prescribed for a vertical cell that contains harmonics as well as regular plucked notes, the regular plucked notes will sound louder than the harmonic. The composer should attach an accent mark to a note to prescribe an accent.

Glissando

The composer can prescribe glissando for vertical cells containing artificial harmonics or a combination of artificial harmonics and stopped notes. To this end, a line should be used to connect the notes that are to be performed in this manner.

Embellishment

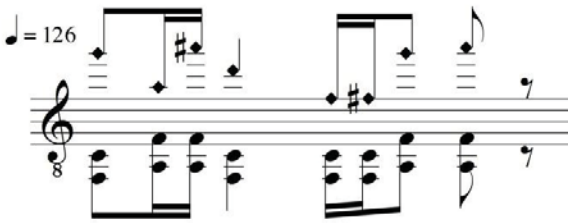
Figure 6.36 Embellishment in vertical cell sequence



Embellishments of vertical cells can be scored by using a glissando embellishment on an artificial harmonic (first measure of Figure 6.36) or by using an embellishment on a regular plucked note (second measure of Figure 6.36). For the sake of playability, it is most effective to keep the vertical cells relatively thin, as in Figure 6.36.

Non-functional writing

Figure 6.37 Non-functional writing



An example of non-functional writing for vertical cell sequences

- Rapid sequences of vertical cells containing artificial harmonics (Figure 6.37)

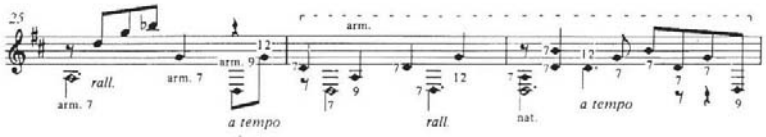
6.3.4 Multiple lines

Design

Figure 6.38 Harmonics in one voice

(DUE CANZONI LIDIE, D'ANGELO)

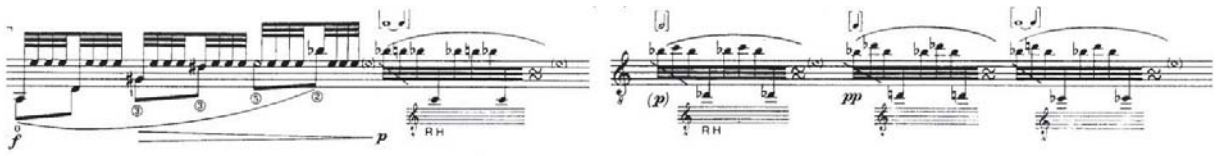
Figure 6.39 Harmonics in two voices[45]



(CANÇO DEL LLADRE, LLOBET)

It is possible to create multiple lines when using harmonics. The composer can score harmonics in one voice (Figure 6.38), or in different voices (Figure 6.39). Natural and artificial harmonics work well for the first type, but when the scoring is more complex and harmonics are dispersed over two voices, natural harmonics are most effective. When scoring multiple voices, the composer should clearly notate these as separate voices.

Figure 6.40 Tremolo and tapping with harmonic resonance

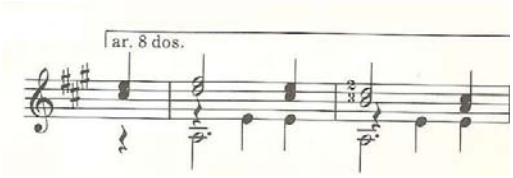


(SEQUENZA XI, BERIO)

A two-part tremolo horizontal cell of plucked sounds can contain harmonics: Berio uses a harmonic on the resonating, initial note of the p,a,m,i tremolo pattern (Figure 6.40). In a tremolo pattern, the harmonic works best on the note that rings on, which the initial note plucked with p usually does, rather than on the repeated note; this last option would require the finger to continue touching the string lightly on the nodal point, hampering its resonance. It is worth noting that Berio lets the natural harmonic in Figure 6.40 ring on for a total of fourteen beats, while the left hand and right hand are playing a variety of trills (these trills, which include right hand hammering, are discussed in more detail in the chapter on hammered sounds). The example shows the duration potential of natural harmonics even when other actions are simultaneously performed.

[45] See comment on Figure 5.100.

Figure 6.41 Reinforced harmonics line[46]



(VARIACIONES SOBRE EL CARNAVAL DE VENECIA, TÁRREGA)

The melodic part of harmonics can be reinforced with an additional note which is played as a regular plucked note (Figure 6.41). Melodic parts consisting of two simultaneously plucked harmonics are only possible when both harmonics are natural harmonics, or when they are artificial harmonics located on adjacent strings with the harmonics sharing the same stopping position of the left hand and the same nodal point. In Figure 6.41, only the notes that are located on top of the melody in thirds are played as harmonics, while the notes that are notated a third below are played as regular plucked notes. The notes all fit within the range of the left hand, and the right hand is used to produce the artificial harmonics.

Resonance

In multiple-part writing with harmonics, the resonance depends on the way the individual parts are scored. Natural harmonics have longer resonance than artificial harmonics, and do not depend on a finger of the left hand to stop them. Therefore, scoring that contains many artificial harmonics tends to have less notes ringing on beyond their notated value than scoring containing many natural harmonics.

Harmonic possibilities

Two-part horizontal cells containing harmonics provide much flexibility in pitch choice, particularly in two-part horizontal cells without many additional notes that reinforce one of the parts. The denser the scoring is, the more limited the harmonic possibilities are.

Speed

When scoring with harmonics, there are two additional elements in comparison to multiple-part writing for regular plucked notes that hamper speed: additional notes that are attached to one or more of the parts, and artificial harmonics. The more these elements are present in scoring, the lower the range of speed. In order to write fast multiple-part passages with harmonics, it is most effective to primarily use natural harmonics and avoid attaching additional notes to the parts, such as the additional notes in Figure 6.41. Tremolo passages that contain harmonics can still be scored at high speeds, if the harmonic is scored as part of the line performed with the thumb, such as in Figure 6.40.

[46] In this example, the composer indicates that the marked pitches should be performed as harmonics, sounding one octave higher. This notation can be confusing for the performer.

Articulation

Multiple-part horizontal cells containing harmonics can be provided with a variety of articulations, such as legato, accents, staccato and glissando.

Legato

Multiple parts can be scored legato, or one part alone may be scored legato while the other part is not (Figure 6.38).

Accents

Accents can be used in multiple parts or in one part while the other is scored with a different articulation. Note that if a harmonic and a regular plucked note are simultaneously performed with an accent, the regular plucked note will sound much louder.

Staccato

Staccato articulations can be used in multiple parts or in one part while the other is scored with another articulation.

Glissando

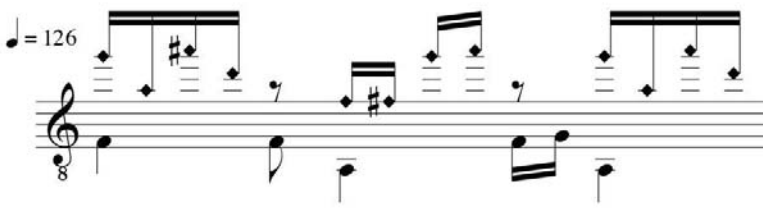
Glissando articulations can be used in multiple parts or in one part while the other is scored with another articulation.

Embellishment

Embellishments containing harmonics can only be scored as cross-string embellishments, because slurs are not available for harmonics. If an embellishment such as the one pictured in Figure 6.38 is scored, the performance of this embellishment takes up many or all of the fingers of the right hand, depending on the right hand pattern that is used. Therefore, if one uses an embellishment in two-part scoring, it is best to silence one of the parts for the duration of the embellishment that is performed in the other part.

Non-functional writing

Figure 6.42 Non-functional writing



Examples of non-functional writing in multiple-part horizontal cells containing harmonics:

- Rapid passages containing artificial harmonics (Figure 6.42)
- Rapid passages containing additional notes attached to one or more of the parts

- Tremolo passages in which harmonics are scored as repeated notes

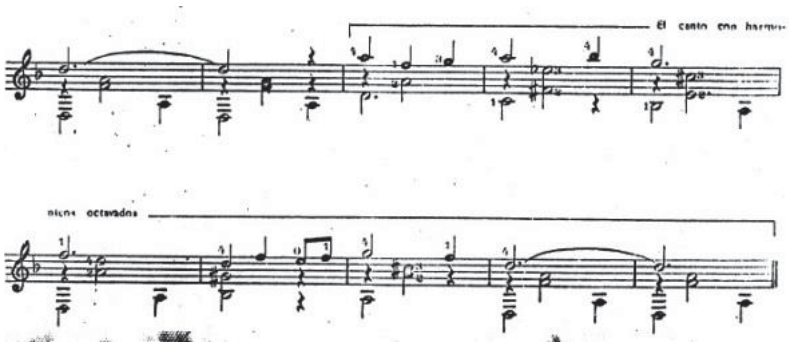
6.4 Textures

Many of the textures containing natural and artificial harmonics found in the guitar repertoire are combinations of different types of horizontal cells. The following examples are presented primarily for the purpose of illustrating how textures in repertoire pieces have been put together.

6.4.1 Textures as combinations of horizontal cells

Melody and accompaniment texture

Figure 6.43 Melody and accompaniment texture with harmonics[47]



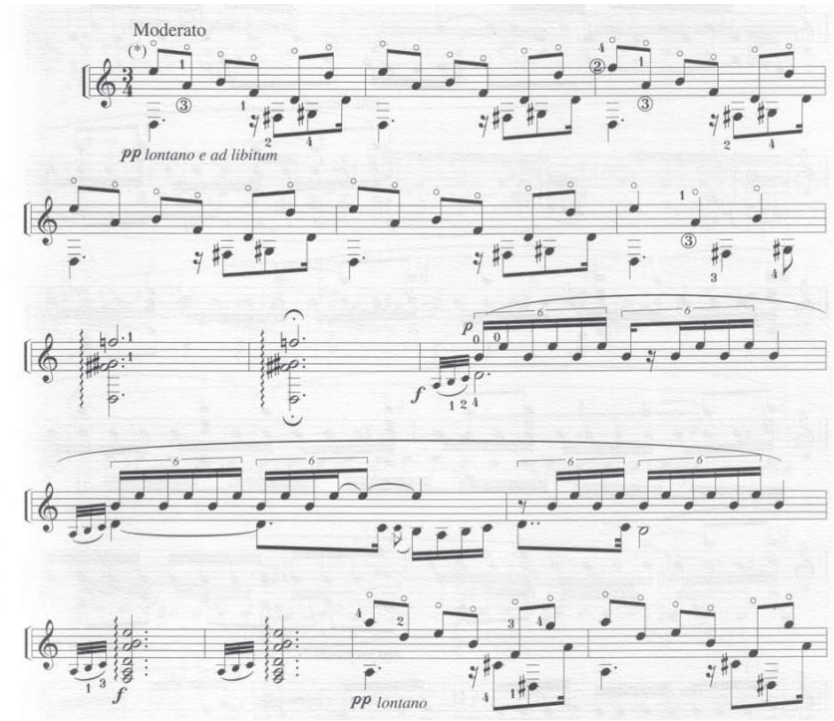
(EL TESTAMENT D'AMELIA, LLOBET)

An effective texture on the guitar is a melody and accompaniment texture in which the notes in the top melody are scored as harmonics (Figure 6.43). Pieces that contain a melody and accompaniment texture of which the melody is scored in the lower playing positions (the melody of Figure 6.43, for instance, is scored in lower positions; position I to III) lend themselves well to such scoring, as the artificial harmonics can be located by the performer with relative ease. In *El testament d'Amelia*, the composition this texture example originates from, the melody is first scored with regular plucked notes, and later echoed in harmonics. The composer can thus use the alternation of regular plucked notes and harmonics as a structural tool in a composition. Instead of scoring the melody on top, it is also possible to create a texture in which the harmonics melody is located on lower strings. In such case it is still worthwhile to keep the melody scored in the lower positions, as this will facilitate performance. For melody and accompaniment textures containing harmonics in the melody, it is best to keep the bass and accompaniment relatively thin, in order for them not to compete in volume with the melody of harmonics.

[47] See comment on Figure 6.41.

Texture of contrasting or alternating cells

Figure 6.44 Two part texture with harmonics alternated with arpeggio[48]



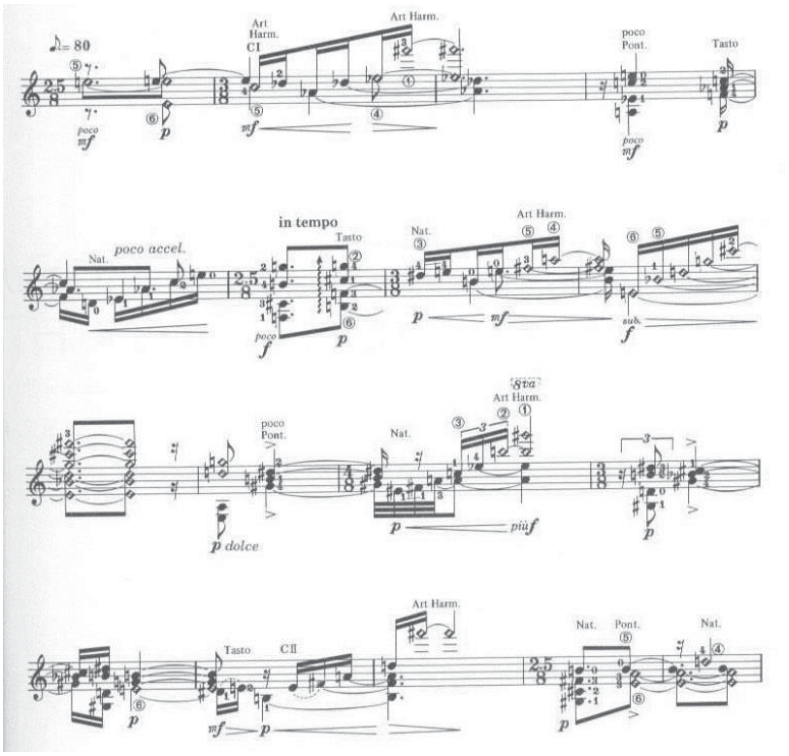
(INVOCACIÓN Y DANZA, RODRIGO)

In *Invocación y Danza*, Rodrigo alternates a two-part horizontal cell with natural and artificial harmonics in the top voice and regular plucked notes in the bass with arpeggio horizontal cells and embellished vertical cells of regular plucked sounds (Figure 6.44). The harmonics in the top voice are a combination of natural and artificial harmonics. The harmonics motive is scored within the range of the left hand span and in a low position, which makes the correct performance of the artificial harmonics easier to achieve for the guitarist. As the natural harmonics ring on after attack and do not depend on a finger of the left hand to ensure their resonance, the opening measures of this passage are characterized by lush resonance of harmonics. The syncopation of the regular plucked bass notes in the opening measures ensures that the basses do not hinder the sound of the harmonics, as they are played in between the attacks of the harmonics. The *forte* basses of the arpeggios that follow represent a break from the etheric, *pianissimo* sound of resonant melodies of harmonics; Rodrigo does not only create contrast between the sound of harmonics and regular plucked notes, but also uses their differing harmonic potential. After two arpeggiated vertical cells that conclude the intermezzo, the soft-spoken melody of

[48] The use of circles above notes to indicate harmonics is not ideal, as the circles can be confused for open string fingerings. In addition, harmonics are not scored at their sounding pitch in this example.

harmonics returns. This score example demonstrates how the composer can use dynamically appropriate sounds to enhance dynamic contrasts, which in this case means that harmonics are used for soft sections, and regular plucked notes for loud sections.

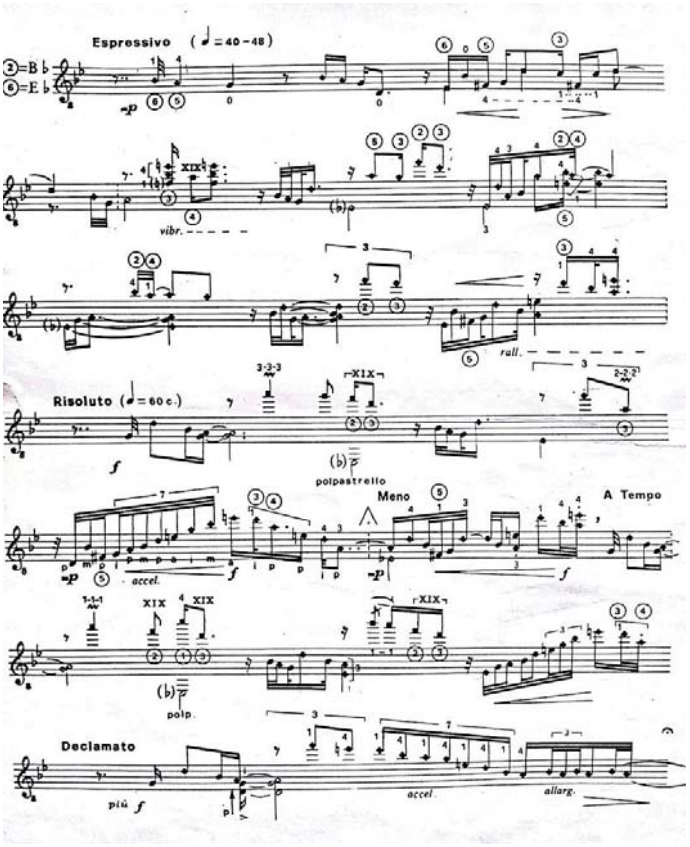
Figure 6.45 Mixed texture containing harmonics



(ALL IN TWILIGHT, TAKEMITSU)

Takemitsu, who makes frequent and widespread use of harmonics in his guitar works, uses a texture in *All in twilight* that alternates arpeggios of harmonics and regular plucked sounds with vertical cell sequences and two-part scoring of plucked sounds (Figure 6.45). In this texture, harmonics are not so much used for creating contrast, but rather as an inherent and natural component of a rich sound world that is intimate, resonant and rapidly fluctuating dynamically between soft and moderately loud. In contrast to the textures of Llobet and Rodrigo that were described earlier, the harmonics do not particularly stand out; regular plucked notes and harmonics are alternated so rapidly, that it is the sound of their entanglement that becomes characteristic for this texture. On the first two lines, harmonics are frequently used to create smooth decrescendos. The *forte* harmonic at the end of the second line is one of the guitar harmonics with the largest dynamic potential: the e in position XII on the sixth string. A frequent occurrence in this texture is the use of vertical cells consisting of both regular plucked notes and harmonics, creating a mixture of the two sounds. In order for such vertical cells to have a balanced sound in terms of dynamics, Takemitsu, appropriately, scores these harmonics in position XII.

Figure 6.46 Mixed texture containing harmonics



(DUE CANZONI LIDIE, D'ANGELO)

In the opening page of *Due Canzoni Lidie*, D'Angelo combines two-part writing of harmonics and plucked sounds with vertical cells and single line writing of harmonics and plucked sounds scored over multiple strings (Figure 6.46). Both natural harmonics (diamond shaped notes) and artificial harmonics (rhomboid shaped notes) appear in this example. A scordatura is used: the sixth string is tuned a semitone down to e flat, while the second string is tuned down a semitone to b flat. The scordatura allows D'Angelo to score pitches as natural harmonics that could not have been produced as natural harmonics in standard tuning; the opening b flat, played as a harmonic in position VII on the sixth string, is an example of such a pitch. The frequent use of natural harmonics and regular plucked notes on open strings in combination with the scordatura creates a sonorous sound world characterized by resonance and unusual pitch combinations. Harmonics are dominant in the high range of this score passage, such as on the fourth line of Figure 6.46, where a voice consisting of natural and artificial harmonics sounds against the backdrop of the detuned e flat plucked "*polpastrello*"; with the flesh. At other times, D'Angelo achieves rapid braiding of natural harmonics and regular plucked notes, such as on the opening of the fifth line, where open strings are braided with natural harmonics in position XII. The scoring of all the harmonics in the septuplet on the last line in one position, in this case position XII, facilitates rapid execution by the performer.

Textures with harmonics as coloristic effect or providers of resonance

See Chapter 5 (Figure 5.100 and Figure 5.102).