

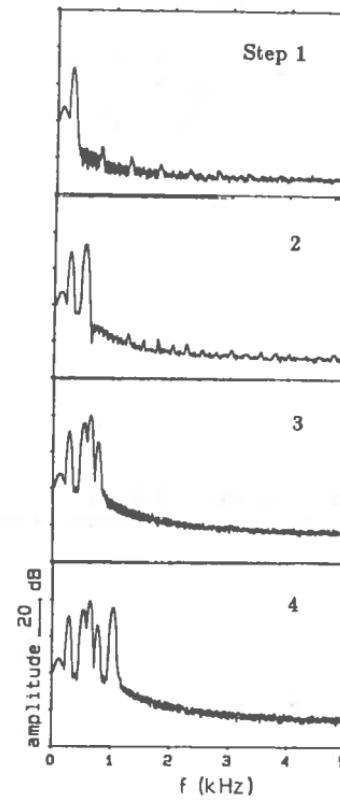
Demonstration 28. Effect of Spectrum on Timbre (1:17)

The sound of a Hemony carillon bell, having a strike-note pitch around 500 Hz (B_4), is synthesized in eight steps by adding successive partials with their original frequency, phase and temporal envelope. The partials added in successive steps are:

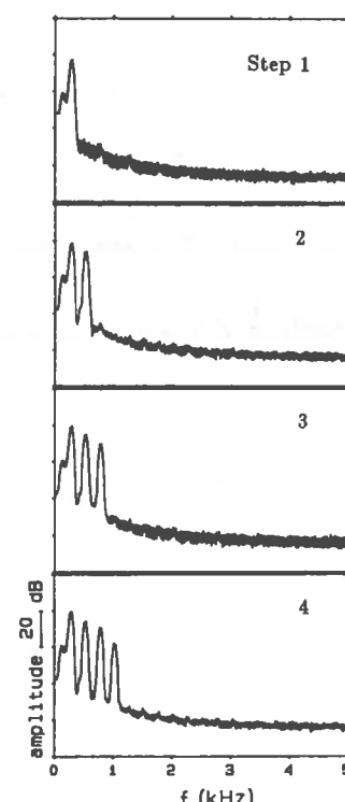
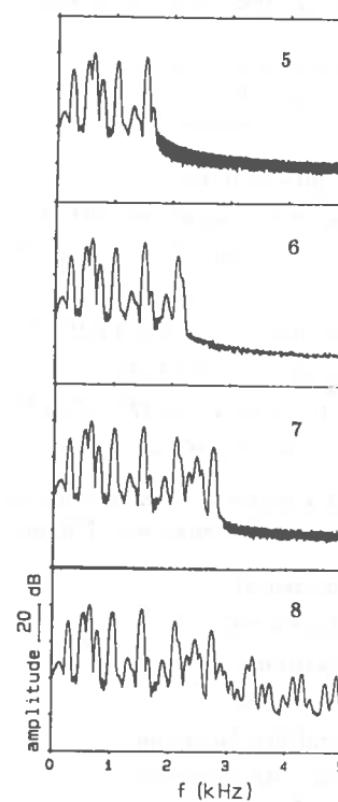
1. Hum note (251 Hz)
2. Prime or Fundamental (501 Hz)
3. Minor Third and Fifth (603, 750 Hz)
4. Octave or Nominal (1005 Hz)
5. Duodecime or Twelfth (1506 Hz)
6. Upper Octave (2083 Hz)
7. Next two partials (2421, 2721 Hz)
8. Remainder of partials

The sound of a guitar tone with a fundamental frequency of 251 Hz is analyzed and resynthesized in a similar manner. The partials added in successive steps are:

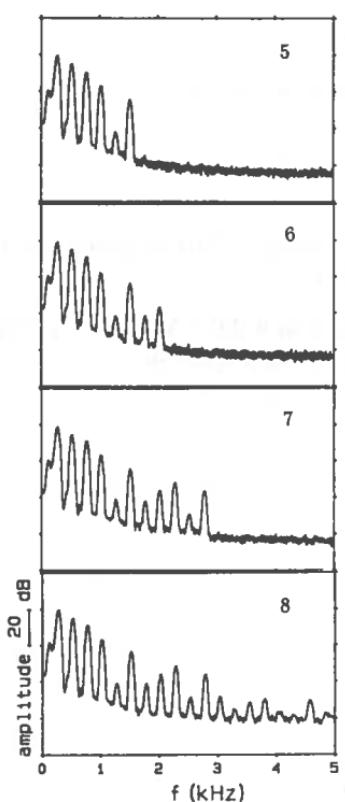
1. Fundamental
2. 2nd harmonic
3. 3rd harmonic
4. 4th harmonic
5. 5th and 6th harmonics
6. 7th and 8th harmonics
7. 9th, 10th and 11th harmonics
8. Remainder of partials



Bell Tone Spectra



Guitar Tone Spectra



Commentary

"You will hear the sounds of two instruments built up by adding partials one at a time".

References

- A. Lehr (1986), "Partial groups in the bell sound," *J. Acoust. Soc. Am.* **79**, 2000-2011.
- J.C. Risset and M.V. Mathews (1969), "Analysis of musical instrument tones", *Physics Today* **22**, 23-30.