

The following plot shows the loudness ratios,  $L_n/L_1$  for the first twenty harmonics (i.e. n < 20) associated with the bipolar sawtooth wave, for  $\beta_{pick} = 0.02$ , for loudness values of the fundamental of  $L_1 = 60 \, dB$  (~ quiet) and for  $L_1 = 100 \, dB$  (~ quite loud). This is what the human ear perceives as the loudness of the harmonics relative to that of the fundamental. Note that the decrease in the loudness ratio,  $L_n/L_1$  with increasing harmonic #, n is extremely slow, in comparison to that associated with the triangle wave, with  $\beta_{pick} = \frac{1}{2}$ , and for the sawtooth wave, with  $\beta_{pick} = \frac{1}{4}$ .



## Harmonic Content of a Sawtooth Wave

■ L\_1 = 100 dB

25

©Professor Steven Errede, Department of Physics, University of Illinois at Urbana-Champaign, IL, 2000 - 2017. All rights reserved