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Application of Physical and Mathematical Transformations in Analyzing Sound Spectrum and Frequency of the Cello BUMJOON CHOI, RICHARD KYUNG, CRG-NJ (Choice Research Group) — The original frequencies of a sound are reduced and represented in a sound spectrum, using dB or Pascal. This sound spectrum characterizes not only the frequencies in sound but also the amount of energy in a frequency band. This paper examines the sound spectrum of musical instruments, such as Cello. The sound wave created by instruments are transformed from time domain to frequency domain. Through studying the sound spectrum, this research analyzes vibrational characteristics and compares such characteristics across several musical instruments. The computational experiment, including the vibrational analysis, is completed with sample sound files using a computer program. The sound spectrum plot of the instrument Cello is created and analyzed to discover the function of the plot. Then, a script for generating spectra plots for any instrument can be generated. When examining the sound spectrum for string instruments, strong peaks at the first and third harmonic components are present. When comparing the sound of the cello and violin, the cello produces a more pure tone and the violin produces a more fuzzy tone. Wood instruments, on the contrary, show strong peaks at the second and/or third harmonic components, rather than the first harmonic component.

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