

Annotated Bibliography

Sam Smith

January 27, 2026

References

- [1] Anil Rai and Buket D Barkana. Analysis of three pitch-shifting algorithms for different musical instruments. In *2019 IEEE Long Island Systems, Applications and Technology Conference (LISAT)*, pages 1–6. IEEE, 2019.

This paper analyzes several widely used pitch-shifting algorithms and includes the underlying mathematical formulas for each algorithm. The methodology section is especially useful because it describes how each algorithm modifies frequency components to change pitch. The authors evaluate the algorithms using measures such as tonality, spectral flatness, and zero-crossing rate, which capture important qualities of sound. Spectral flatness, in particular, will be relevant for my project because it reflects how “clean” or noisy a processed signal sounds. The paper also cites a wide range of pitch-shifting techniques, making it a helpful resource for comparing algorithm choices and understanding how they affect sound quality and processing latency.

- [2] Ruohua Zhou, Joshua D Reiss, Marco Mattavelli, and Giorgio Zoia. A computationally efficient method for polyphonic pitch estimation. *EURASIP Journal on Advances in Signal Processing*, 2009(1):729494, 2009.

This research paper outlines a new method for estimating polyphonic pitches. At the heart of the process is the constant-Q Fast Resonator Time-Frequency Image (RTFI) analysis, which is essentially a function that is able to track the time-frequency characteristics of the input signal. The paper formally breaks down the method into two main processes: time-frequency analysis and post-process phases. Section 3.2 further breaks down the steps into 5 core components, most notably: using RTFI to calculate the time-frequency energy spectrum, calculating the harmonic components and computing pitch candidates and removing noise. The paper includes additional citations, all of which use different methods for estimating polyphonic pitches, which may be good for comparing methods and better understanding the problem as a whole.