Abstract

Two different models for measuring auditory roughness were created to see how humans perceive loudness in dissonance and harmonic tones. Estimated Fletcher-Munson curves that show the relation between frequency of pitches and their loudness was incorporated into a MATLAB code. This MATLAB code used roughness measures by Sethares. Then dissonance graphs were produced from the MATLAB code that also compared Sethares original dissonance curve with the new dissonance curve that incorporated the Fletcher-Munson curves. Then two different models were created with constant amplitude harmonics and exponential decreasing harmonics. The constant amplitude harmonics curve showed that there was significance in perception of loudness in dissonance curves compared to Sethares dissonance curve. However, the exponential decreasing harmonics curve was very similar to the Sethares dissonance curve.

Introduction

The inspiration for this research was based on the work done by Sethares. For the past 20 years he has been analyzing sensory dissonance and its relation to musical analysis and composition. Most of his work was based on amplitude and the roughness in the harmonics. The main purpose in this research is to incorporate phons into dissonance curves which allows us to measure the loudness for a certain frequency.

Methods and Materials

- A Fletcher-Munson curve (left) was estimated to make the interpolation curves (right) to be used in MATLAB. This will allow the program to convert to phons which are used to measure loudness.

- A roughness curve, created by Sethares, was coded into MATLAB and used to compare the new dissonance curves. These new curves were created using the estimated Fletcher-Munson curve.

Results & Discussion

There were two different models created in MATLAB. The first model created used exponential decreasing harmonics whereas the other model had constant amplitude harmonics. Each dissonance curves has Sethares curve to compare to, which is in blue.

Conclusion

The red line in the figure below shows the constant amplitude harmonic curve with the Fletcher-Munson curve. This curve is very different from Sethaes’s roughness curve. It shows similar trends in the dissonance level right after the musical interval 0, and at interval 2. The interval at 1.5 has a greater dissonance whereas there is less dissonance right before 1.5. Right between 1.5 and 2 the dissonance is greater compared to Sethaes’s curve. This shows that when tones are played at constant amplitudes, the dissonance in certain tones are more noticeable to the human ear.

Acknowledgements and References

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