

## Part 2.1

### Lead guitar with distortion

<https://freesound.org/people/pitx/sounds/16400/>

I choose that sound because I am interested in trying the models with a distorted electric guitar. It is an instrument that we still haven't used in the examples of the course. I think it can be more challenging than acoustic instruments, because there are many partials that are introduced by the distortion effect, so I don't know how well it will translate to the harmonic model. The sound also have some reverb which can be problematic as well. It will probably contain much more residual/stochastic part.

## Part 2.2

When the guitar is palm-muted, it creates a lower sound, and more noisy. When it has clear pitch, we see that the harmonics go all the way up until 18kHz. I can see that the minimum fundamental could be around 90Hz, while the maximum fundamental could be around 200Hz, although the more defined pitches are between 120-200. Therefore, there could be a maximum of around 150 harmonics (by  $18000 / f_0$ ), but probably many of them are hard to hear.

## Part 2.3

\* window type: blackman

Blackman has 6 bins main lobe and smaller side lobes, which proves to be adequate to detect the  $f_0$  and the harmonics well.

\* window size: 3001

I used this size, because I experimentally checked that it was more accurate when recognizing fundamental and harmonics than smaller sizes, and there are not very fast frequency changes .

\* FFT Size: 4096

This was a size that gave enough resolution, and it's the next power of 2 of the window size.

- \* minimum  $f_0$ : 120

I could see in the spectrogram that minimum  $f_0$  was 120Hz or more. Lower frequencies only confused  $f_0$  detection.

- \* maximum  $f_0$ : 220

I could see in the spectrogram that maximum  $f_0$  was less than 220Hz. Higher frequencies could confuse  $f_0$  detection with the second harmonics

- \* error threshold in  $f_0$  detection: 4

Smaller thresholds will start to not recognise properly the fundamental and make artifacts

- \* maximum number harmonics: 40

I started on 120 harmonics, and went down experimentally until 40, because I think this offers a good compression ratio without compromising the output so much.

- \* stochastic decimation factor: 0.6

We achieve a good rate of compression, but lower factors will start to have a big impact, specially on the lower frequencies which are important on the palm-muted sound.