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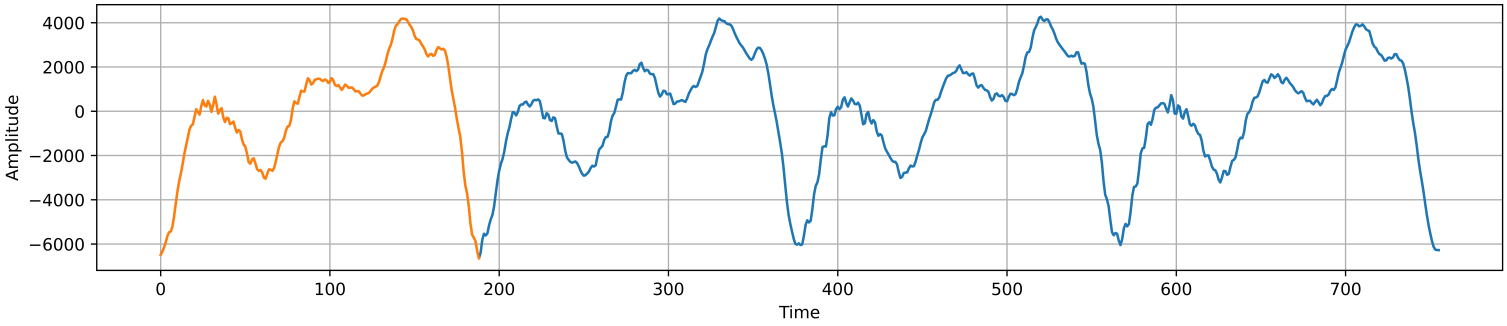
DSP - Project 1

1. Phoneme /a/ waveform

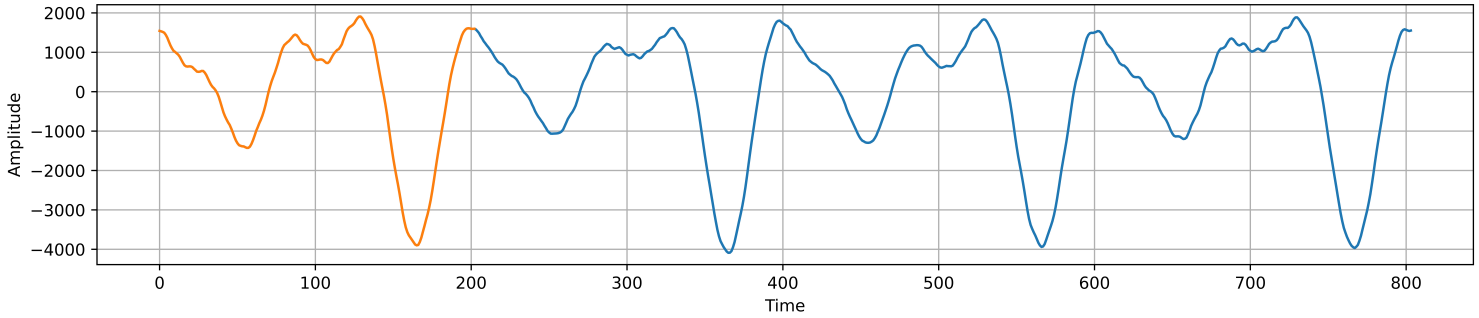
Max Amplitude value throughout the wave: 5518
Min Amplitude value throughout the wave: -6809



As the plot indicates, some kind of periodicity (visible pattern) is detected in the sound wave, with a time period of about 189 time steps where approximately 3 peaks and 3 troughs emerge in each. The vowel /a/ is a central low and unrounded voiced phoneme, suggesting that the vocal cords are semi-open while letting the air flow from the lungs towards the vocal tract. All the articulators are positioned in such a way to allow the unhindered air flow in the oral cavity.

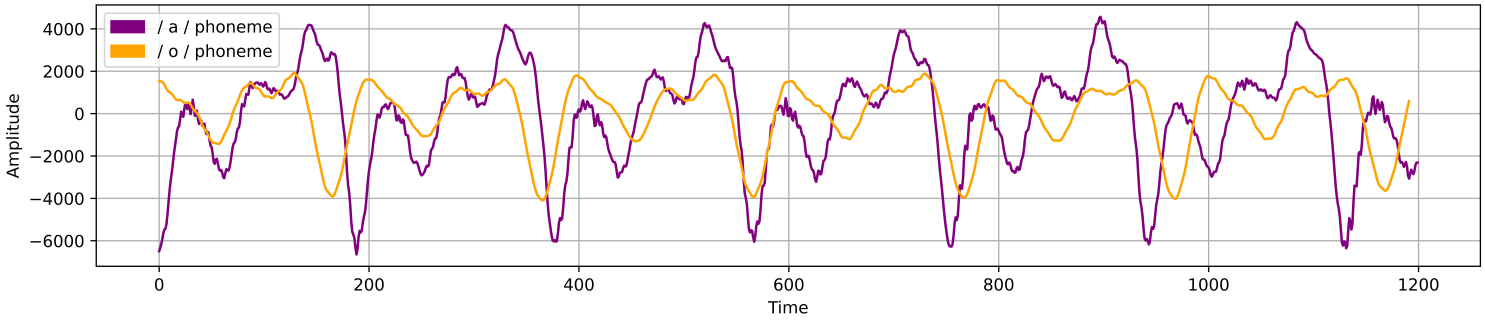
2. Phoneme /o/ waveform

Max Amplitude value throughout the wave: 2039
Min Amplitude value throughout the wave: -4121



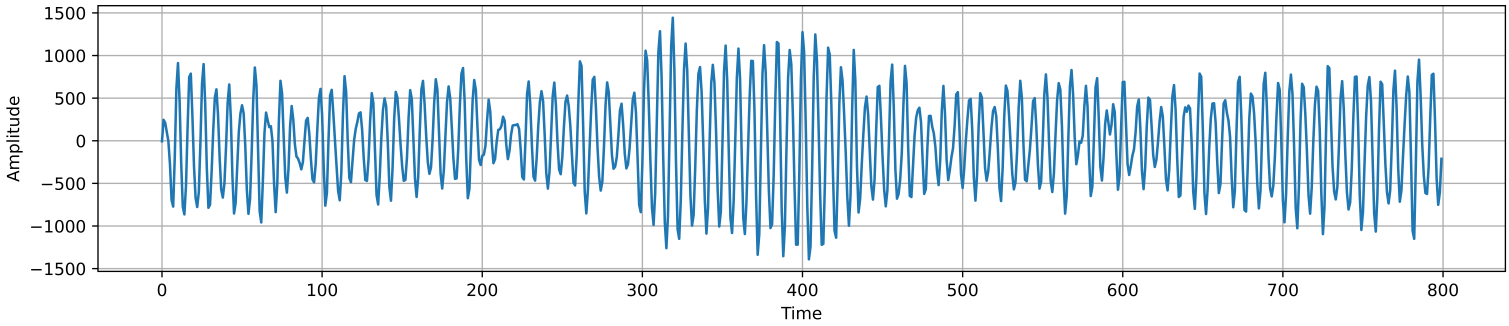
The pattern here, has a time period of about 203 time steps. Three peaks and three troughs were distinguished in the pattern. The /o/ vowel also resides in the category of the voiced phonemes, so the same apply to it (concerning resonance). It is a mid-back rounded vowel.

Both phonemes concern greek vowels ([a], [o]), the sound waves of which exhibit patterns that are characterised by periodicity. Generally, in the case of the vowels, the vocal cords are adducted and vibrating, producing sound waves with certain frequency (pitch) each and other characteristics depending on the rest of the articulators' position and movements. Phoneme /a/ is more sonorous than phoneme /o/, a remark that could have been made soon after a casual comparison between the two plots above (after examining the amplitude attribute).



3. Phoneme /s/ waveform

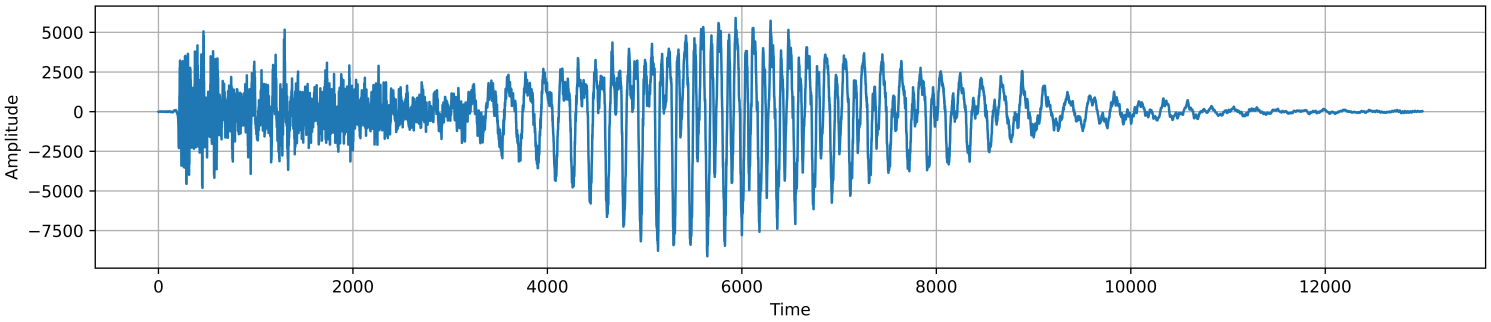
Max Amplitude value throughout the wave: 2003
Min Amplitude value throughout the wave: -2304



The sound of "s" is more like an aperiodic hissing (noise) - with a possible random pattern in some parts of the signal, as observed from the plot above. This sound is produced by air flowing through constricted articulators, producing audible frictional turbulence, which is the phoneme / s/. The vocal cords are abducted,

4. Phoneme /k/ waveform

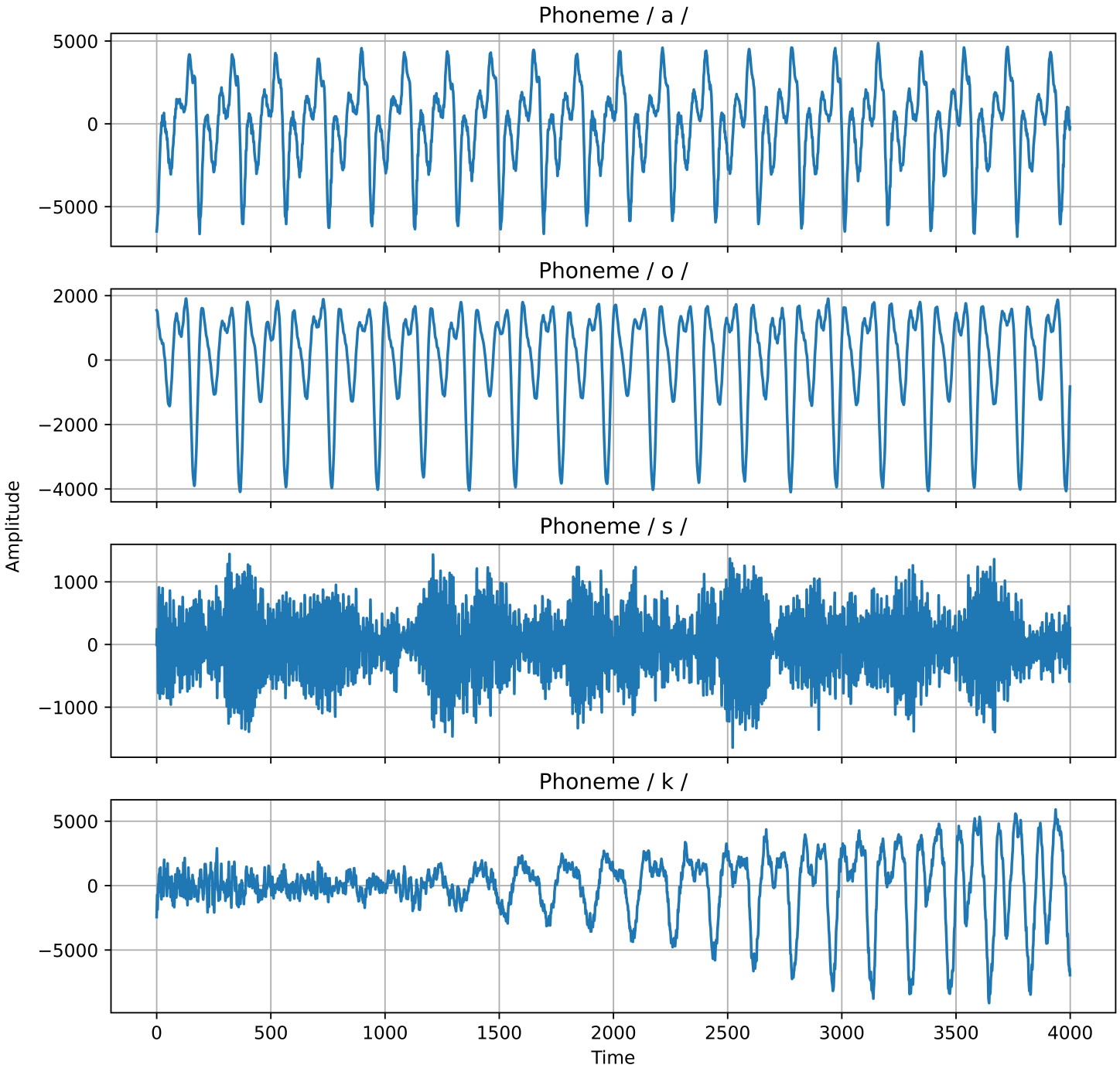
Max Amplitude value throughout the wave: 5907
Min Amplitude value throughout the wave: -9117



Here, the plot indicates an aperiodic sound without any patterns, commencing abruptly with a burst, followed by a stronger burst some milliseconds afterwards. That signal suggests a stop phoneme, such as the voiceless /k/. During the production of this consonant, the outgoing airstream is obstructed, then intraoral pressure is being built up and finally, as the graph shows, the air is released producing the noise burst which is the sound of /k/.

Both phonemes concern voiceless consonants ([s], [k]) with no consistent patterns in the produced sound waves.

Conclusions



All the plots above are in the same zoom scale (time). By comparing the four representations visually, we can make some interesting conclusions about those two vowels ([a], [o]) and the two consonants ([s], [k]):

- The vowels' sound waves have clear or almost clear patterns that repeat themselves throughout the signal in (almost) the same way. On the contrary, the consonants' waves usually have random patterns without repetition consistency or even no patterns at all.
- The consonants' waveforms are more dense than the vowels'. They carry more information during the same time frame (4000 time steps), especially phoneme /s/.
- The above, might be a result of the the different articulation of each phoneme, as well as the nature of the sound produced by this specific movements of the vocal tract.