DSZOB, cvičenie 7.

Zadanie:

Úloha 1 - Formantová analýza

Načítajte si nahrávku z dokumentového servera (vowels.m4a).

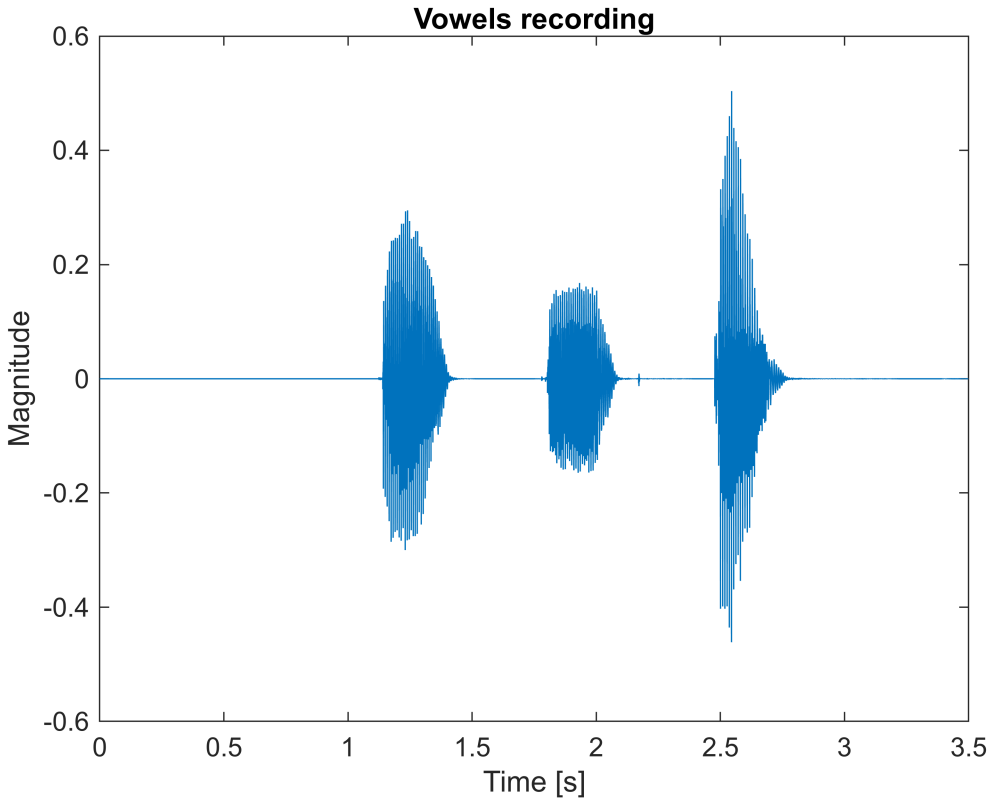
Vykonajte analýzu jednotlivých samohlások pomocou spektrogramu v danej nahrávke. Identifikujte hodnoty jednotlivých formantov. Na základe tabuľky sa pokúste identifikovať o aké anglické samohlásky ide. Overte si výpočet vypočutím nahrávky.

Ako pomôcku môžete použiť nasledujúcu tabuľku:

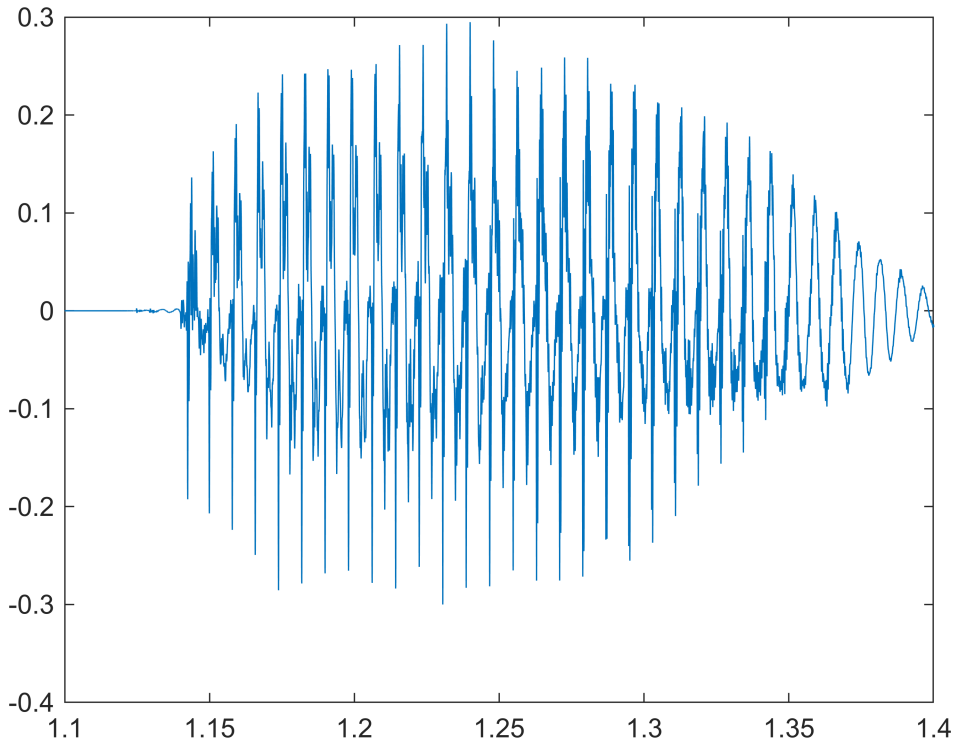
Short vowels	/a/		/e/		/i/		/o/		/u/	
	Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd
F1	548	80	448	44	367	48	441	34	355	32
F2	1268	132	1899	194	2086	73	1009	130	1370	313
F3	2519	395	2985	583	3215	449	2659	394	2556	368
Long vowels	/a:/		/e:/		/i:/		/o:/		/u:/	
F1	666	70	448	38	326	26	451	45	345	21
F2	1156	49	2048	95	2178	74	860	152	1213	223
F3	2287	266	2946	449	2971	272	2402	362	2330	165

Solution:

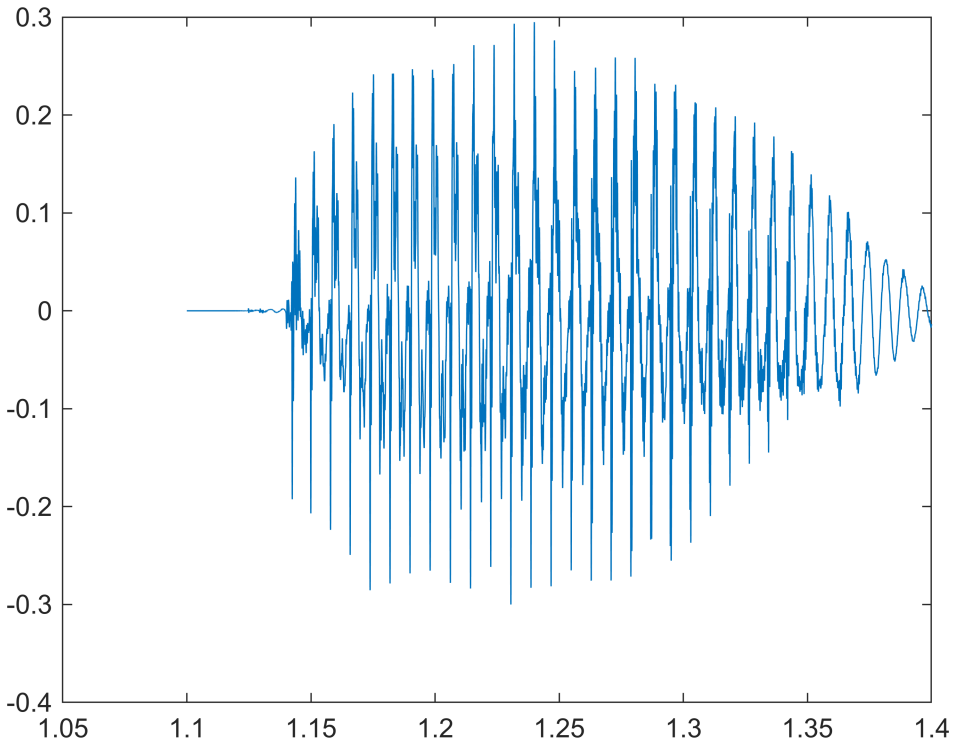
```
% Riešenie / Solution
clear;
vowel = audioread("Asignments\Assignment_6\vowels.m4a");
vowel_info = audioinfo("Asignments\Assignment_6\vowels.m4a");

fs = vowel_info.SampleRate;
time_axis = 0:1/fs:vowel_info.Duration;

plot(time_axis, vowel);
title("Vowels recording");
xlabel("Time [s]");
ylabel("Magnitude");
```



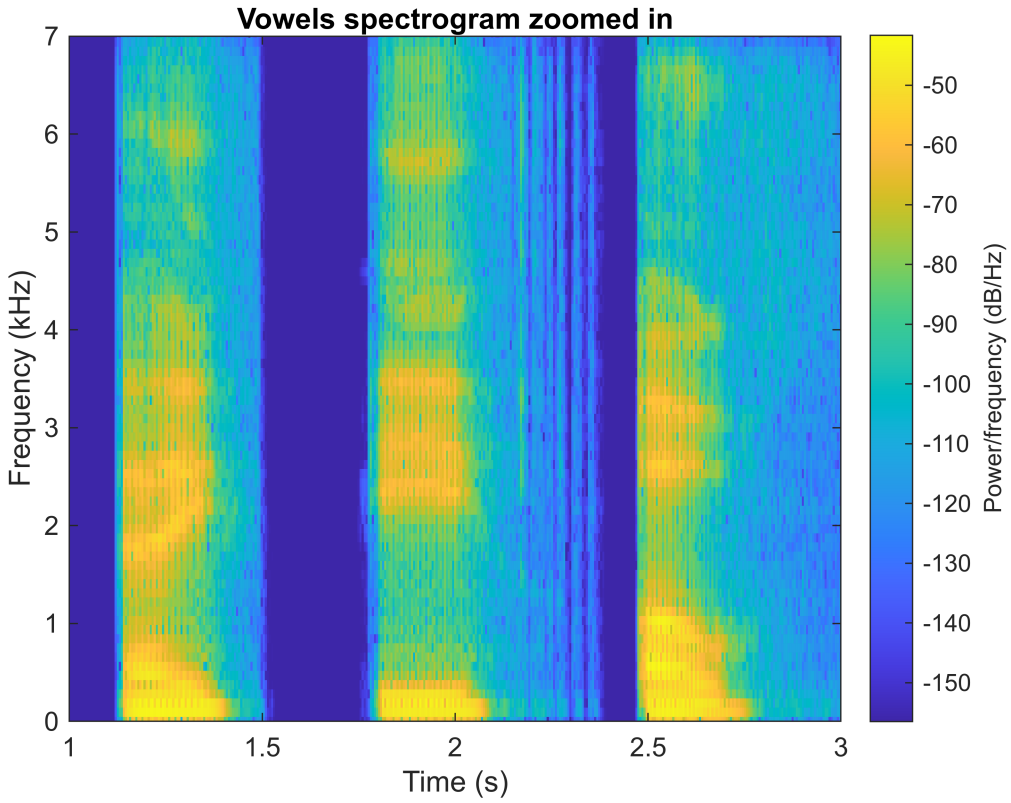

```
% Finding time range of first vowel
plot(time_axis, vowel);
xlim([1.1, 1.4])
```



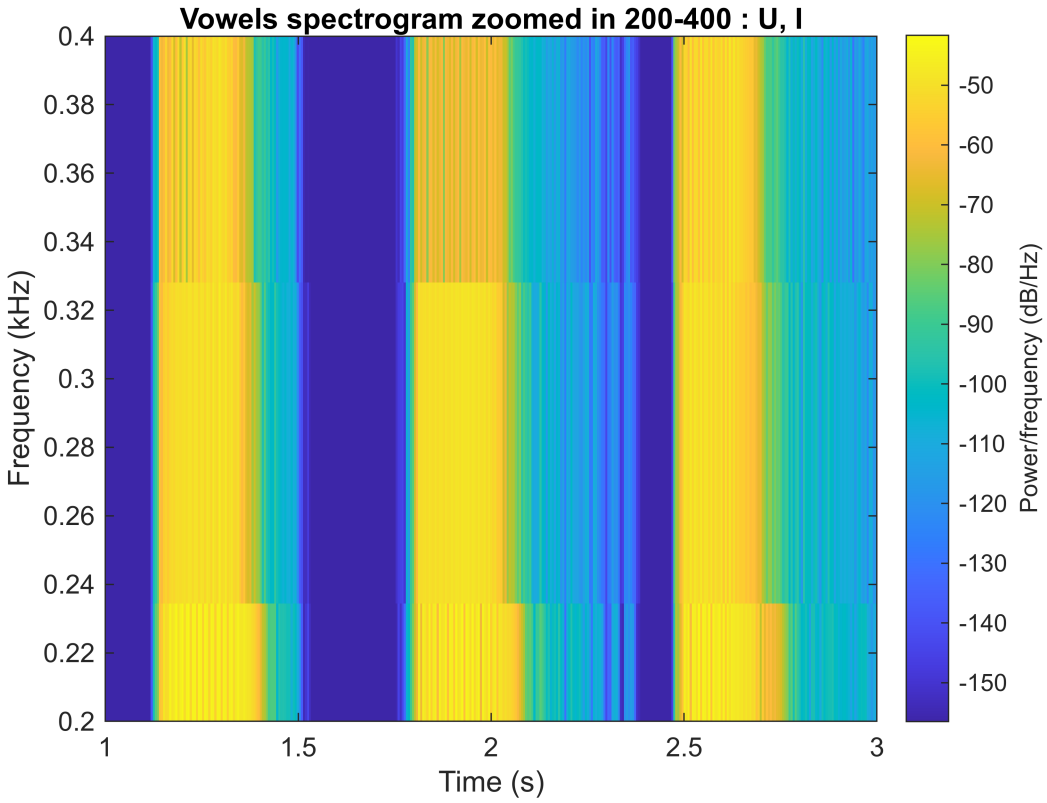

```
%sample for one vowel
start = round(fs*1.1);
finish = round(fs*1.4);

vowel_sample = vowel(start:finish,:);
time_axis_sample = time_axis(:,start:finish).';
plot(time_axis_sample, vowel_sample)
```



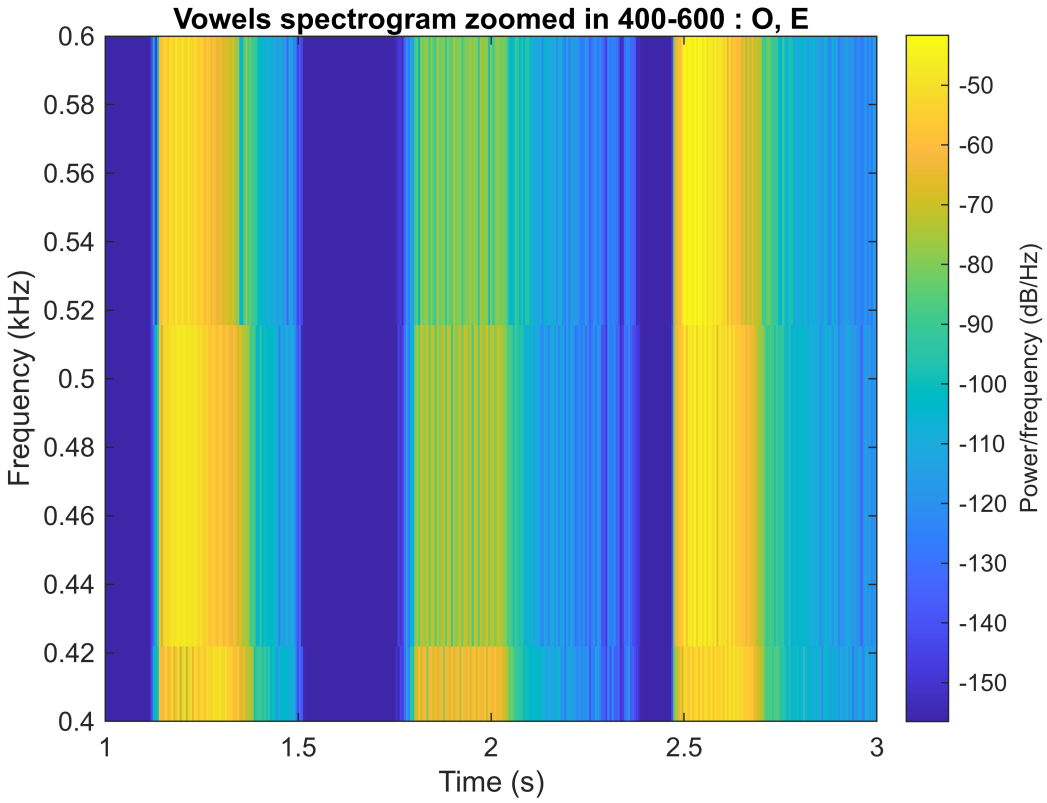

```
spectrogram(vowel, hamming(512), 256, 512, fs, 'yaxis');
ylim([0, 7]);
xlim([1,3]);
title("Vowels spectrogram zoomed in");
```



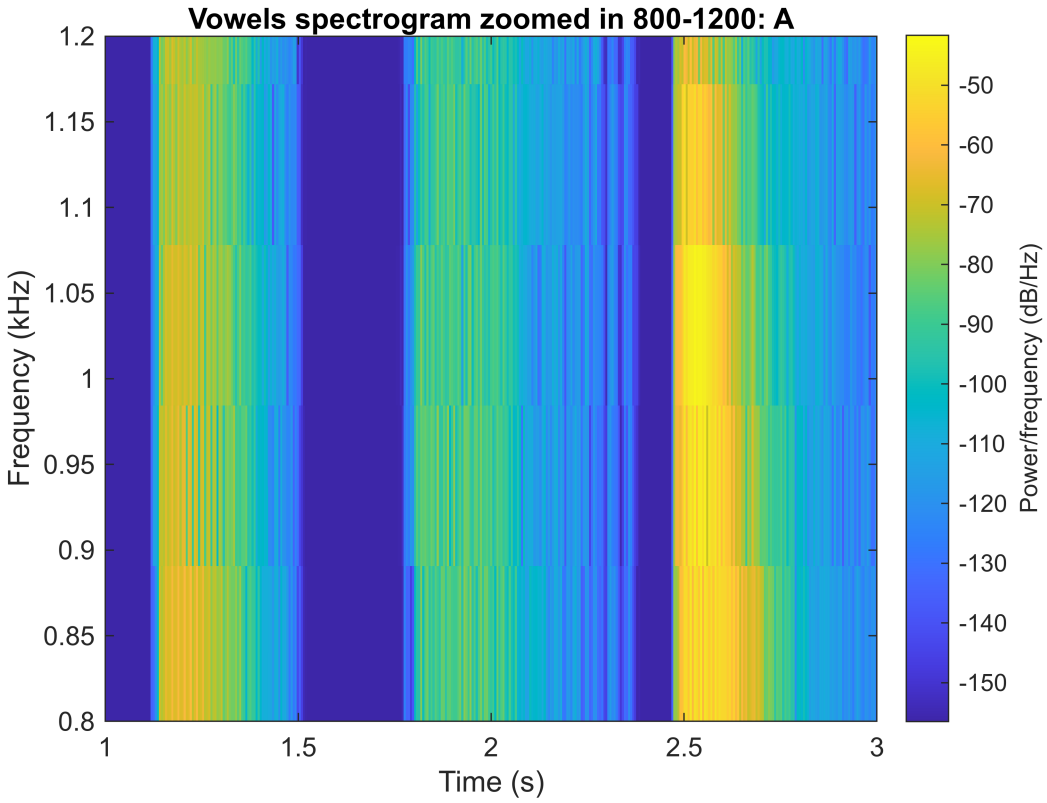

```
spectrogram(vowel, hamming(512), 256, 512, fs, 'yaxis');
ylim([.2,.4]);
xlim([1,3]);
title("Vowels spectrogram zoomed in 200-400 : U, I");
```



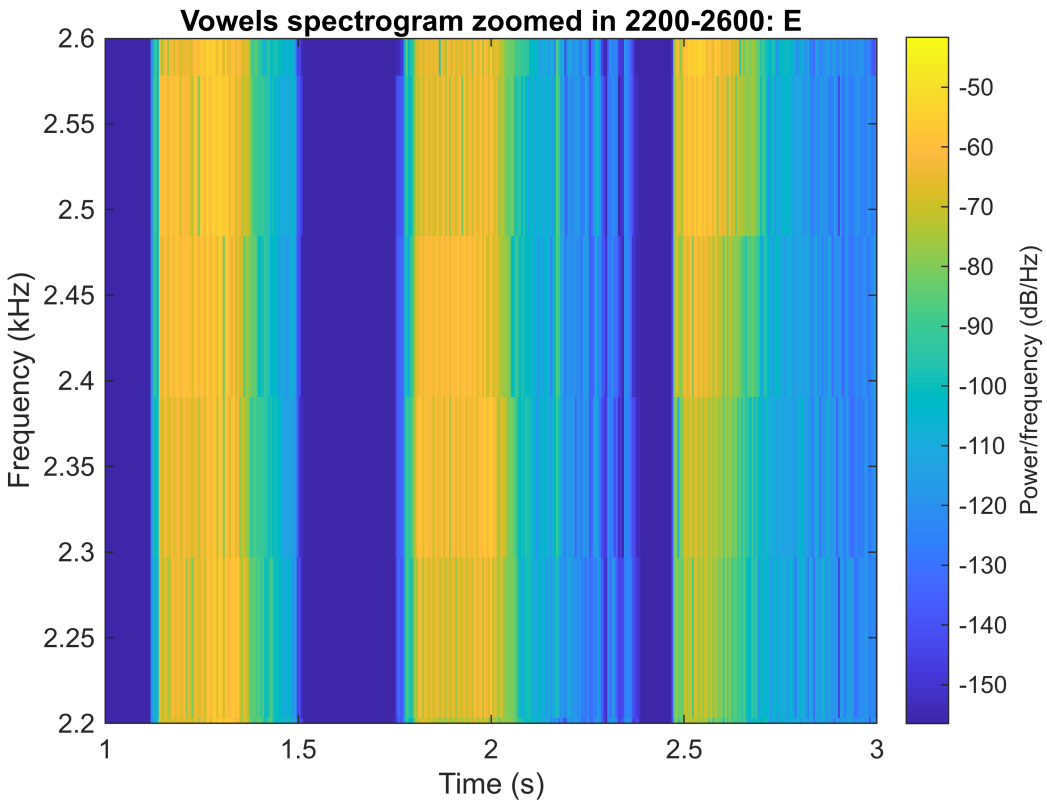

```
spectrogram(vowel, hamming(512), 256, 512, fs, 'yaxis');
ylim([.4,.6]);
xlim([1,3]);
title("Vowels spectrogram zoomed in 400-600 : O, E");
```



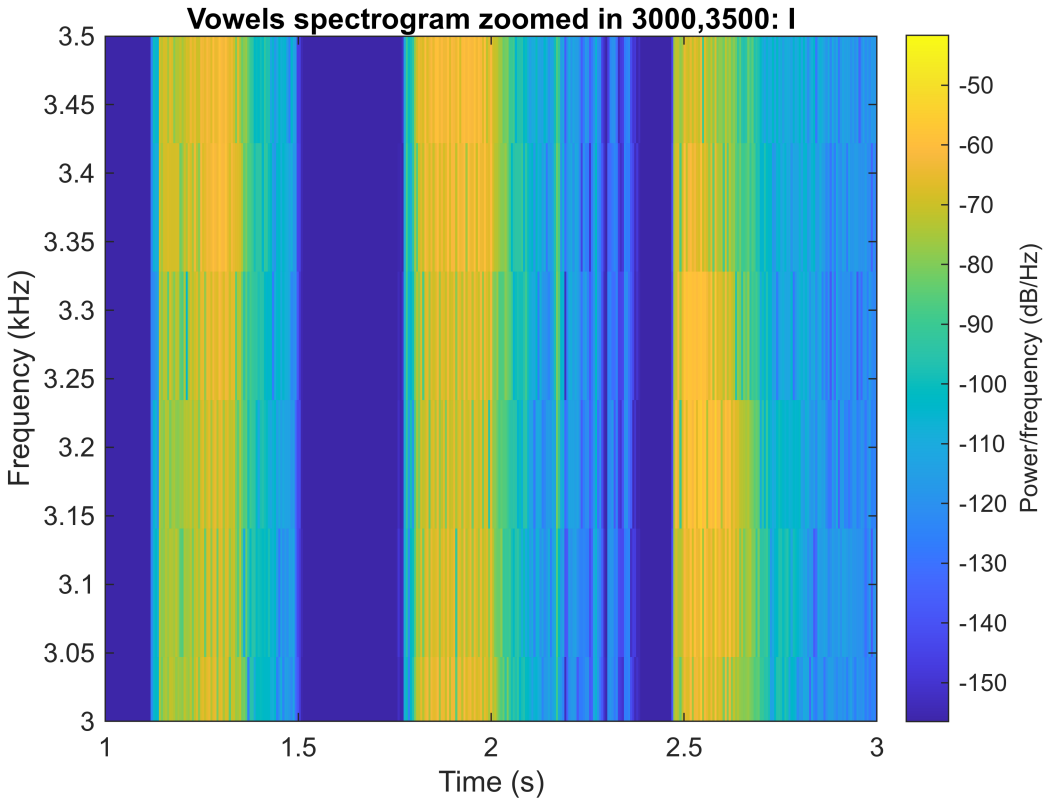

```
spectrogram(vowel, hamming(512), 256, 512, fs, 'yaxis');
ylim([.8,1.2]);
xlim([1,3]);
title("Vowels spectrogram zoomed in 800-1200: A");
```




```
spectrogram(vowel, hamming(512), 256, 512, fs, 'yaxis');
ylim([2.2,2.6]);
xlim([1,3]);
title("Vowels spectrogram zoomed in 2200-2600: E");
```




```
spectrogram(vowel, hamming(512), 256, 512, fs, 'yaxis');
ylim([3,3.5]);
xlim([1,3]);
title("Vowels spectrogram zoomed in 3000,3500: I");
```




```
% first o, middle u, last a (my guess)
%playblocking(audioplayer(vowel, fs));
% ok it was a, i, o
```

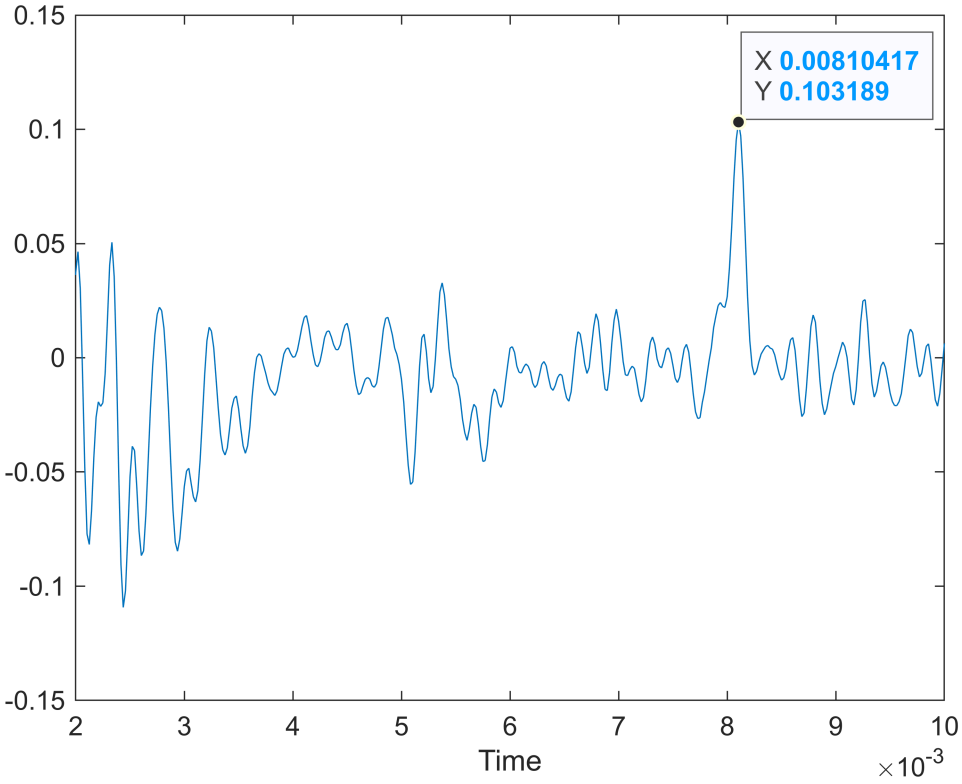
Zadanie 2 - Fundamentálna frekvencia

Pre jednu z hlások z nahrávky vykonajte odhad fundamentálnej frekvencie pomocou complexného cepstra.

1. Vezmite okienko 2048 hodnôt zo stredu zvolenej samohlásky
2. Pre toto vybrané okno vypočítajte complexné cepstrum (cceps)
3. Vizualizujte peak vo výsledku v rozsahu približne 0.002 - 0.01s
4. Vypočítte príslušnú frekvenciu nájdeného peaku (f = 1/T)

```
% Riešenie / Solution
middle_sample = vowel_sample(round(length(vowel_sample)/2) - 1024:
round(length(vowel_sample)/2) + 1024);
plot(0:1/fs:2048/fs ,cceps(middle_sample))
xlim([0.002, 0.01])
xlabel("Time")

% Generated by matlab after highlighting point
ax = gca;
```

```
chart = ax.Children(1);
datatip(chart,0.008104,0.1032);
```




```
% Frequency of found peak
1/0.00810417
```

```
ans = 123.3933
```

```
% Found peak of 0.103, at time 0.00810417
% Frequency of the peak is 123.3933
```