PROJECT REPORT

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Question - 1:

The tuning curves in figure - 1 and 2 are semilog plots. The curves seem to peak around 500 Hz and 4000 Hz, respectively. We can infer from them that each of the two ANFs have the highest firing rates when the frequency of the stimulus corresponds to their characteristic or best frequency.

Figure - 3 shows the rate versus intensity plot for both ANFs at different intensities. The graph must ideally look like a sigmoid. For the given data, we see that the rate of firing increases more rapidly with increase in intensity beyond a certain point. It should then go ahead and stagnate. This would indicate that there is a dynamic range of intensities, where rate of firing increases proportionally.

Figure (1) :

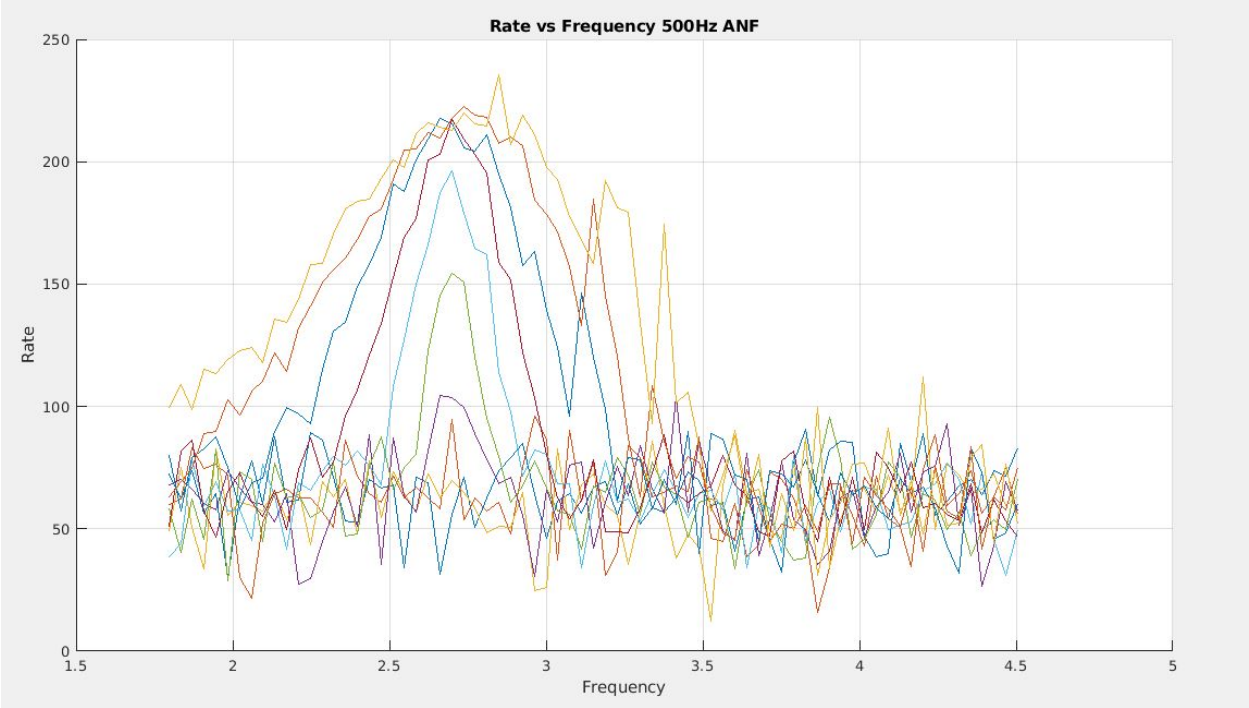


Figure (2) :

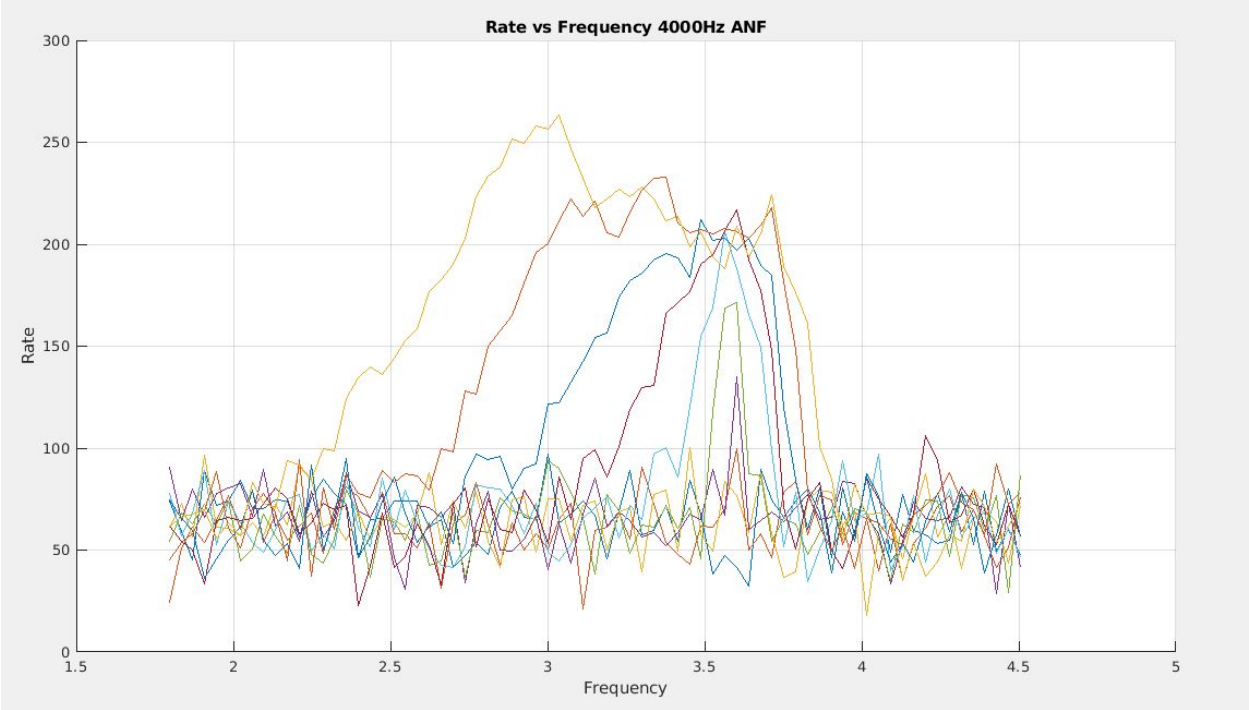
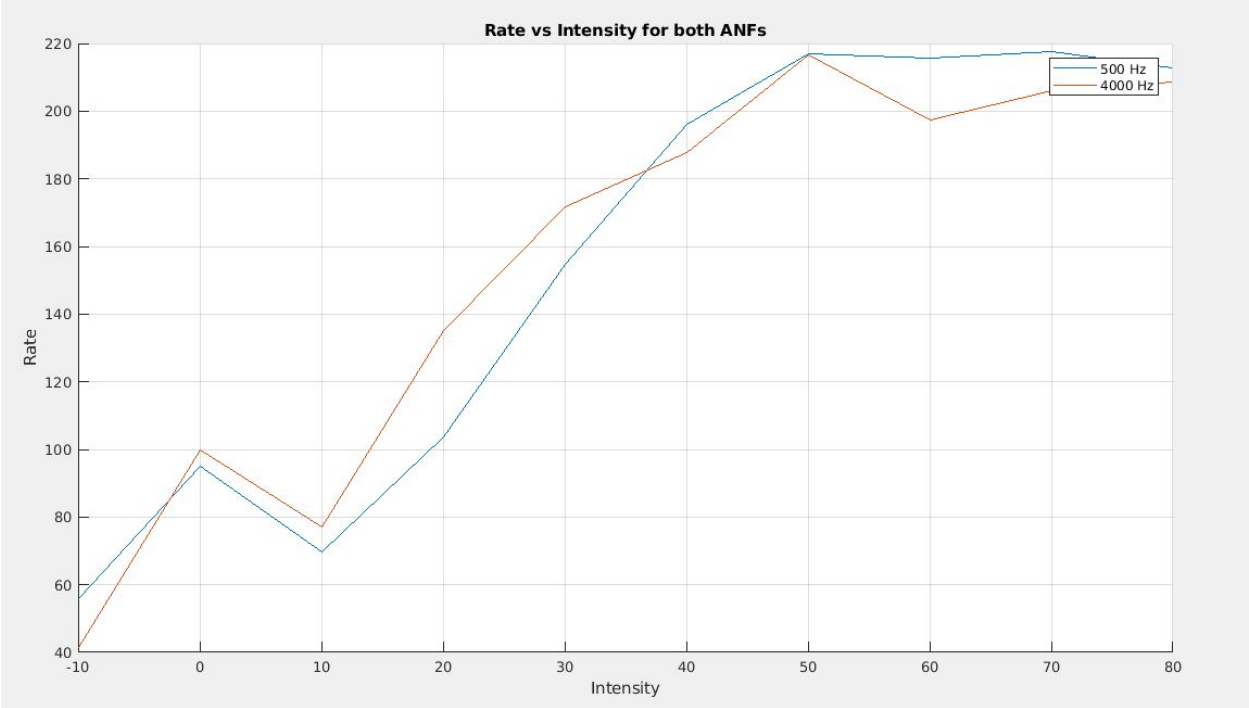


Figure (3) :



Question - 2:

The code starts by determining 3 sound levels (in dB), that are sufficiently different from each other in terms of rate responses of a 500Hz ANF. This is done by generating and plotting the average rates against intensity, as in figure - 4, and picking 3 intensities, namely, 0dB, 35dB, and 70dB. Further, the psths for 54 ANFs ,i.e., 81Hz to 8000Hz (values of BF below 80Hz are not accepted by the model) are determined for the stimulus being played at the above intensities.

Figure - 5 is the spectrogram of the speech signal. Beyond this, we shall use the 70 dB input, since that closely resembles the actual signal. Different window sizes, as listed in the question, are used and psth values are averaged within the window, as it slides over the entire response. These are plotted in a manner akin to a spectrogram, the ANF frequencies being on the y-axis, time on the x-axis, and the colour of a spot representing its rate. The plots turn out to be very similar to the actual spectrogram. The aforementioned plots can be found in figure - 6.

Figure (4) :

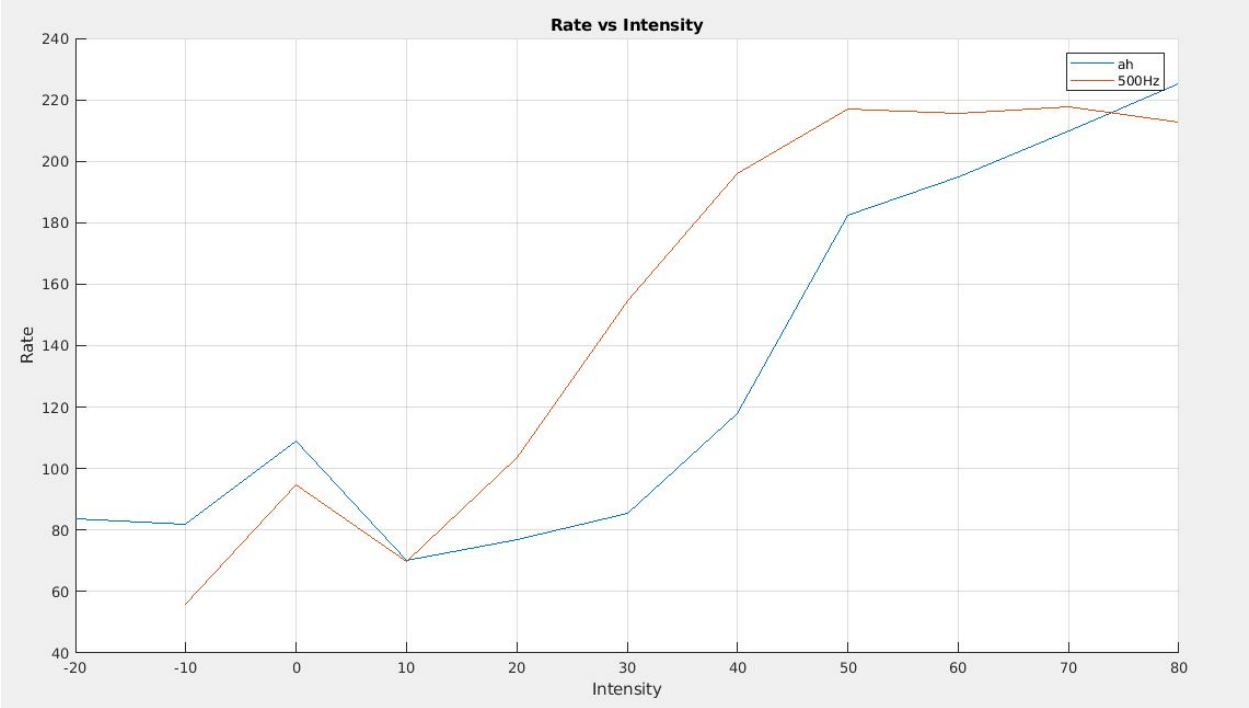


Figure (5) :

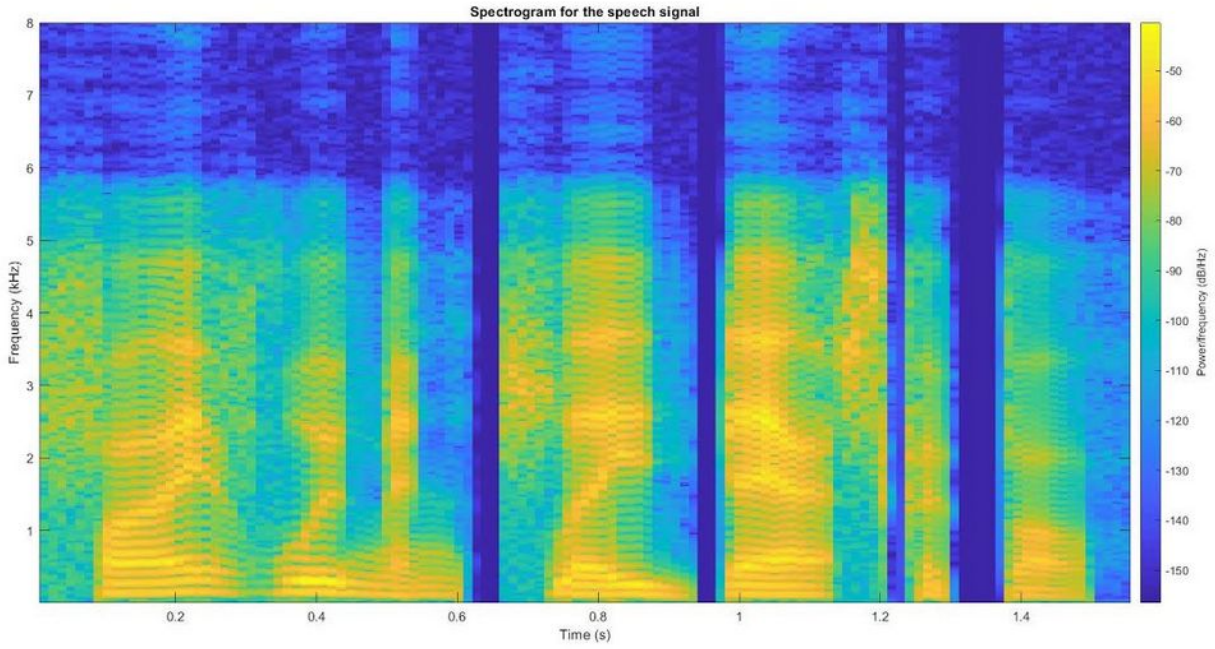
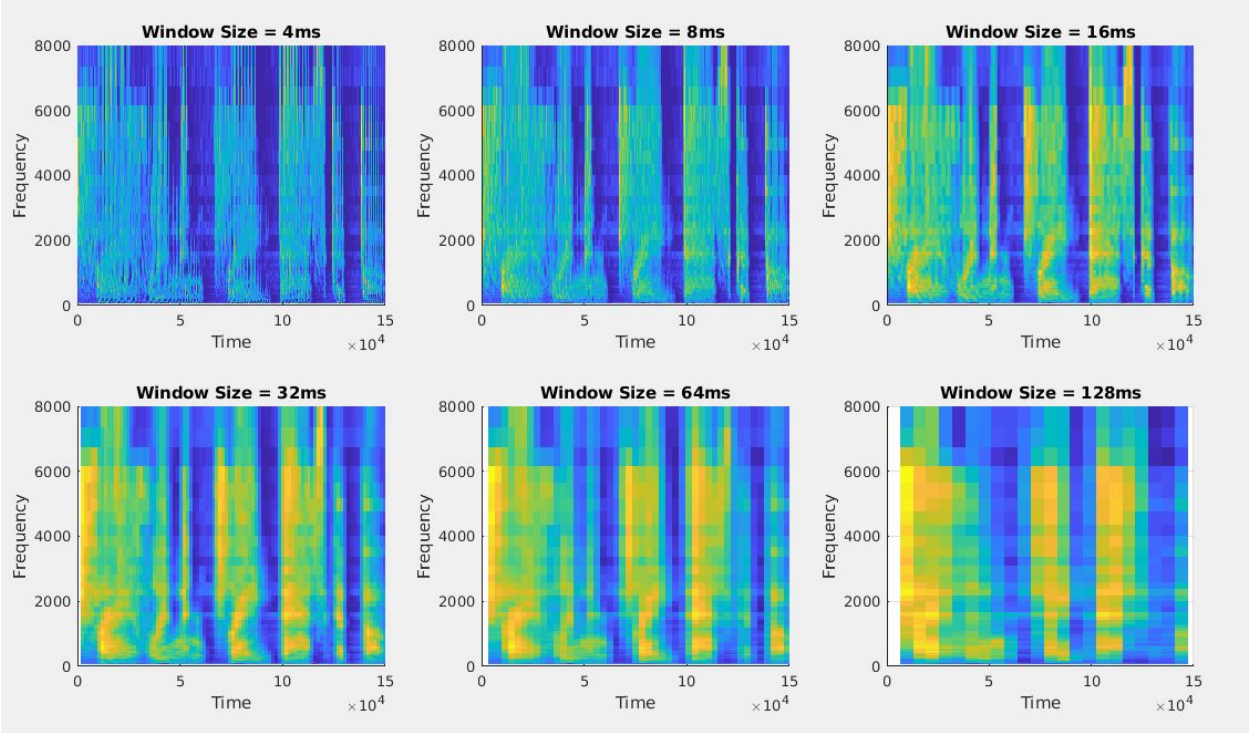


Figure (6) :



Question - 3:

A window of size 12.8 ms is slid over the aforementioned psths, and a Fast Fourier Transform is computed within it. This FFT is observed to be symmetric about the midpoint. To remove the DC component, or 0 Hz component, we subtract the mean of the psth from the psth. The frequencies range from 0 to Fs, where, Fs is the sampling frequency (100 kHz). The maximum value of energy and the corresponding frequency is found out and stored against the mid- time point of the window. When these frequencies are plotted on the spectrogram at time points corresponding to the respective windows, the following is observed. All such points belonging to a certain ANF seem to be located around the BF of that fibre. They tend to be located in the maximum energy regions in the spectrogram. (Refer to figure - 7)

Figure (7) :