MATLAB REPORT 2

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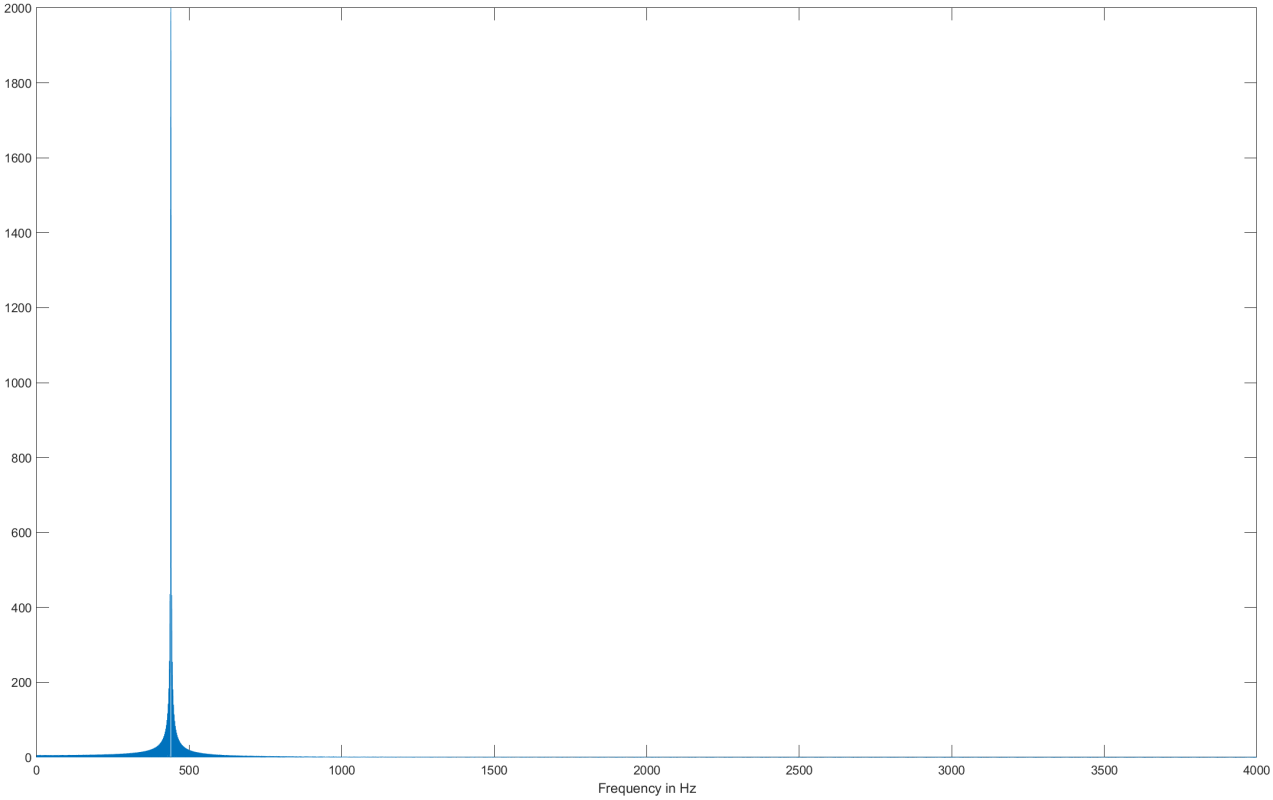
#1)

soundsc (one2nine, 22000) → Heard woman count 1 to 9

soundsc (one2nine, 15000) → Heard man count 1 to 9, relatively slower

soundsc (one2nine, 30000) → Heard childish voice count 1 to 9, relatively quicker

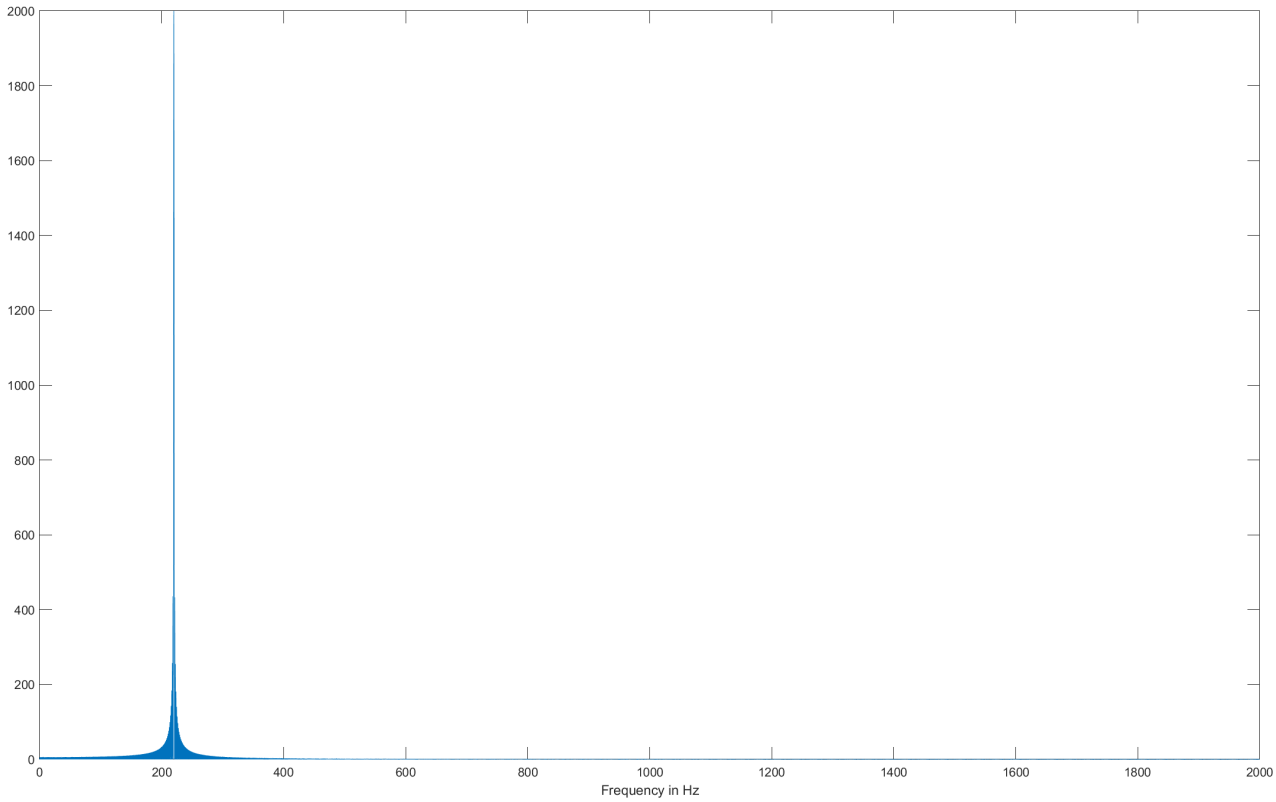
#2)



(a) Frequency range = 0Hz to 4000Hz

(b) 50000 means the number of points used in frequency vector

(c) Dominant frequency = 440.00Hz



(d)

$$\text{Modified dominant frequecny } \approx \frac{440.00}{2} Hz \approx 220.00 Hz$$

Explanation:
Fs is directly proportional to dominant frequency. Since Fs is halved (8000Hz→4000Hz), then dominant frequency is also halved.

#3)
(a)

$$\begin{aligned}
\omega &= \cos^{-1}\left(\frac{x[n]+x[n-2]}{2x[n-1]}\right) \\
&= \cos^{-1}\left(\frac{x[2]+x[0]}{2x[1]}\right) \\
&= \cos^{-1}\left(\frac{-1.9444+0.3042}{2*(-0.8509)}\right) \\
&\approx 0.26987\ldots \\
&\approx 0.2699 \quad (4 \text{ sig.fig.})
\end{aligned}$$

(b)

$$x[n] = A\cos(\omega n + \phi)$$

$$
\begin{aligned}
\text{sub } n &= 0 \\
x[0] &= A\cos(0+\phi) \\
0.3042 &= A\cos(\phi) \; --(1)
\end{aligned}
$$

$$
\begin{aligned}
\text{sub } n &= 1 \\
x[1] &= A\cos(\omega+\phi) \\
-0.8509 &= A\cos(\omega+\phi) \; --(2)
\end{aligned}
$$

$$
\begin{aligned}
\text{sub } n &= 2 \\
x[2] &= A\cos(2\omega+\phi) \\
-1.9444 &= A\cos(2\omega+\phi) \; --(3)
\end{aligned}
$$

$$
\begin{aligned}
(2)\;/\;(1)\;: \frac{-0.8509}{0.3042} &\approx \frac{\cos(\omega+\phi)}{\cos(\phi)} \\
-2.797 &\approx \frac{\cos(\omega+\phi)}{\cos(\phi)}
\end{aligned}
$$

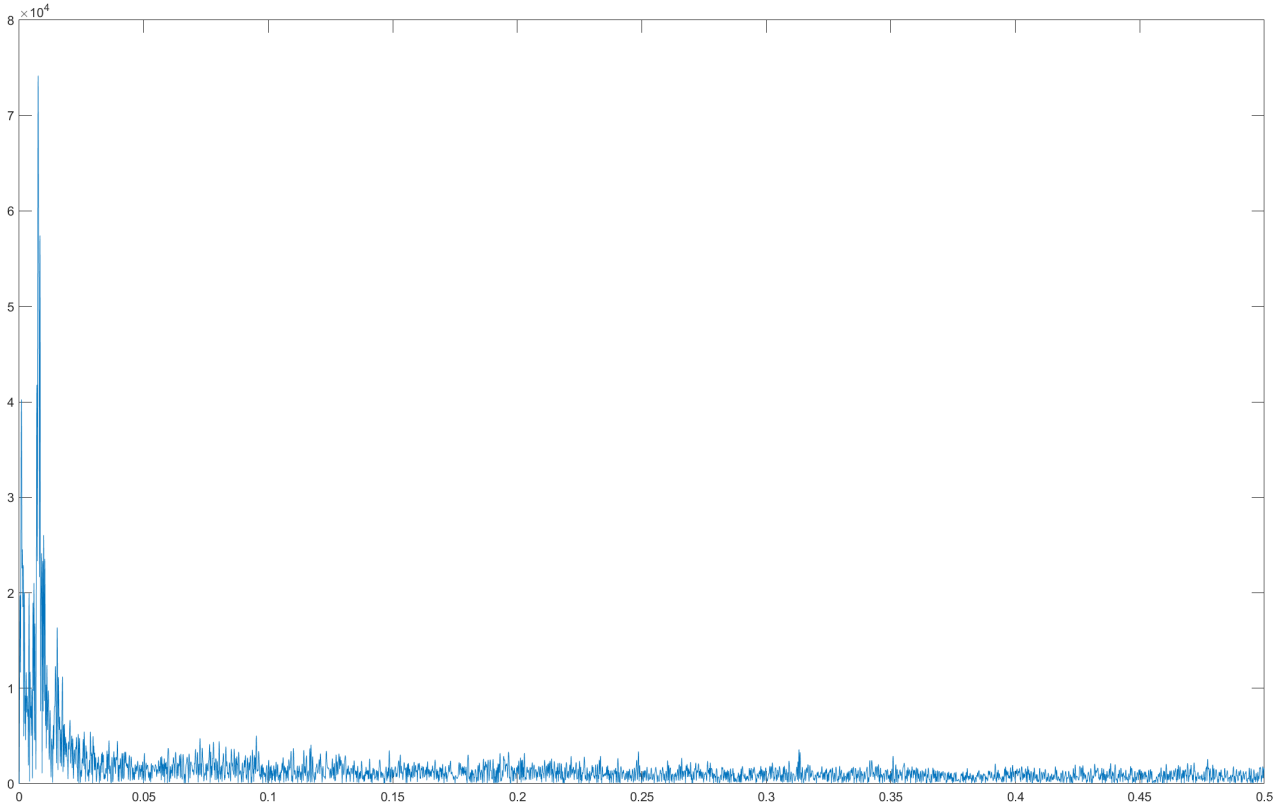
$$
\begin{aligned}
(3)\;/\;(2)\;: \frac{-1.9444}{-0.8509} &\approx \frac{\cos(2\omega+\phi)}{\cos(\omega+\phi)} \\
2.285 &\approx \frac{\cos(2\omega+\phi)}{\cos(\omega+\phi)}
\end{aligned}
$$

$$
\begin{aligned}
\mathrm{A} &= 4.3019 \\
\phi &= 1.5000 rad
\end{aligned}
$$

(c)

$$
\begin{aligned}
f = \frac{\omega}{(2\pi T)}, T = &\text{ sampling interval} \\
f = \frac{15.4630}{2\pi 0.002} &= 1.2305 \times 10^3 Hz
\end{aligned}
$$

#4)

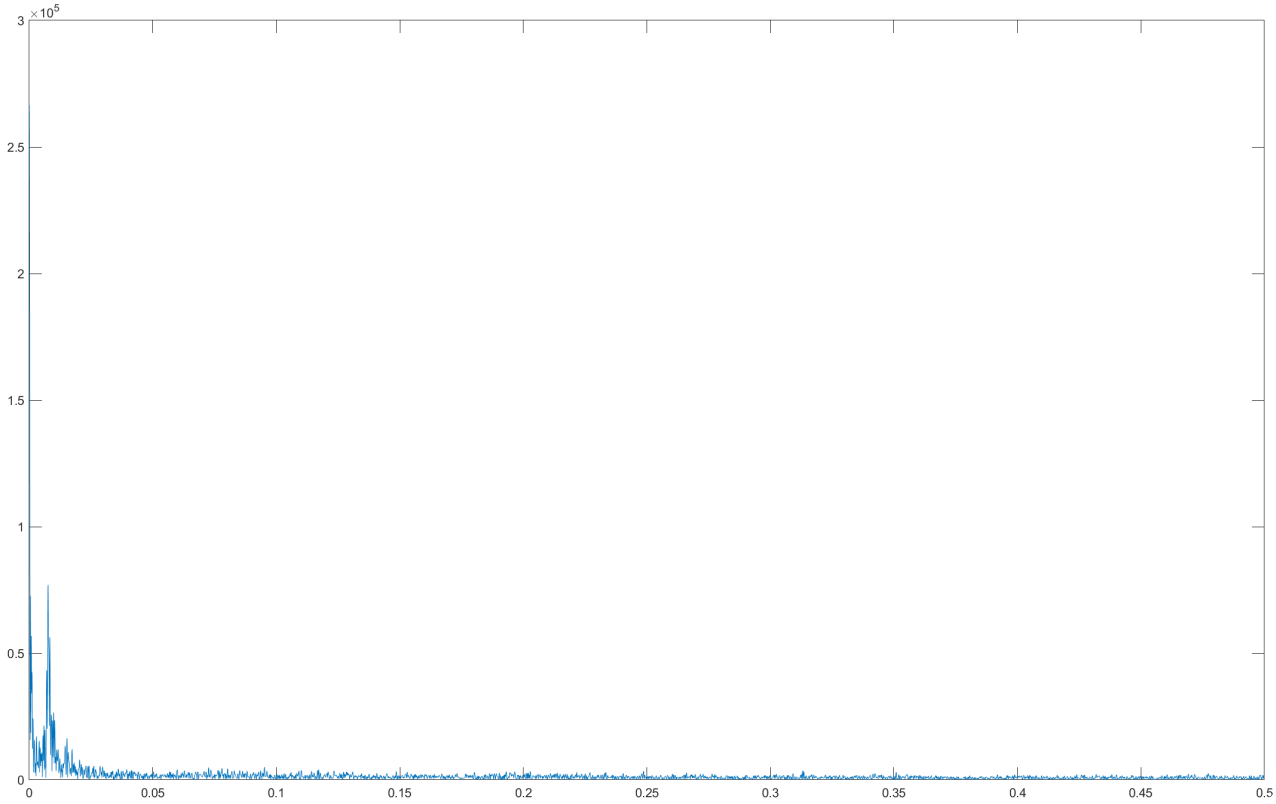


(a) Dominant frequency = 74718.6Hz

(b)

$$Cycle(months) = \frac{1}{\text{Dominant frequency}} = \frac{1}{74718.6} = 1.338354841 \times 10^{-5} \approx 1.338 \times 10^{-5}$$

(c)



To identify the sunspot cycle, locate the highest peak from the graph as dominant frequency. Then use formula $\frac{1}{f}$ to find the cycle. Note that the mean value might affect dominant frequency if not subtracted.

(d)

The purpose of "ssn=ssn-mean(ssn)" is to center the signal or data by subtracting its mean, indicating that no DC offset is removed. Removing the command and hence eliminating mean allows more focused analysis on oscillations in the signal.