VE216
Introduction to Signals and Systems

HOMEWORK 3 ATTACHED PAGES

April 7, 2020

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6. The Fourier series representation of 4(a) is

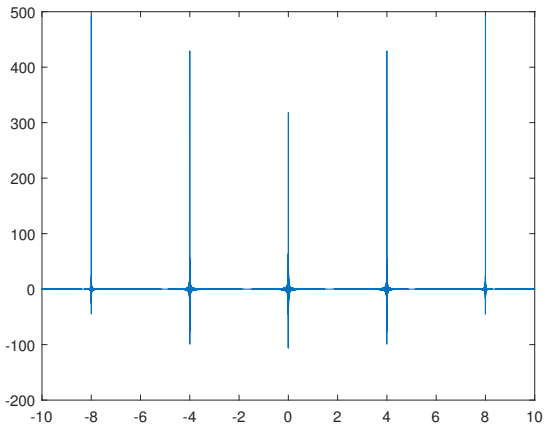

Figure 1. 6-1.

The Fourier series representation of 4(b) is

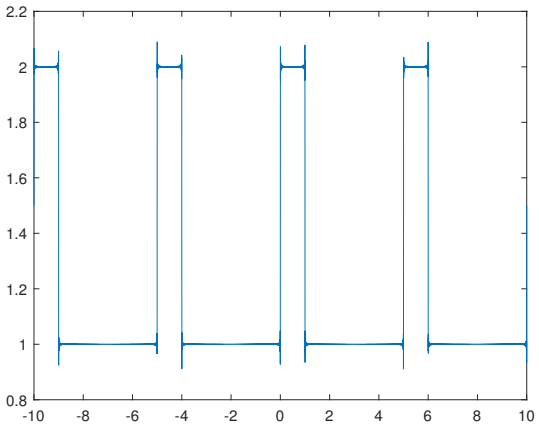

Figure 2. 6-2.

The Fourier series representation of 4(c) is

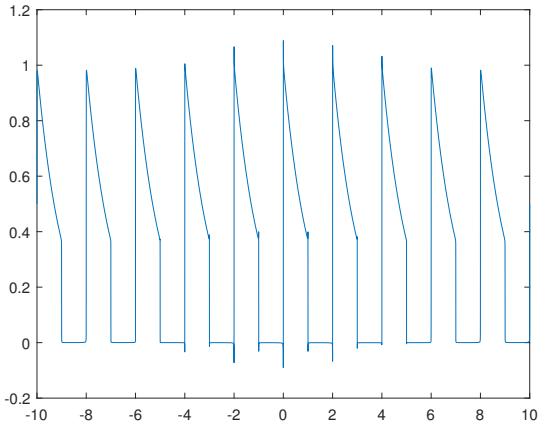

Figure 3. 6-3.

8.
(a) The graph of $S_N(t)$ with $N = 5$ for $t \in [0.5, 4.5]$ is

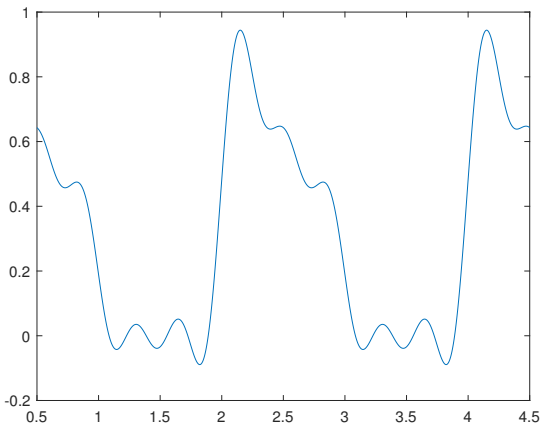

Figure 4. 8(a)-1.

The graph of $S_N(t)$ with $N = 10$ for $t \in [0.5, 4.5]$ is

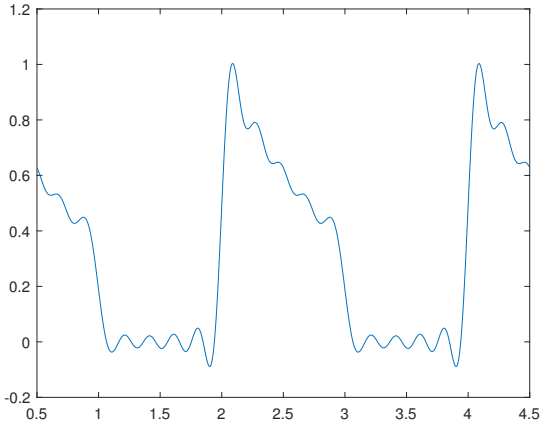

Figure 5. 8(a)-2.

The graph of $S_N(t)$ with $N = 15$ for $t \in [0.5, 4.5]$ is

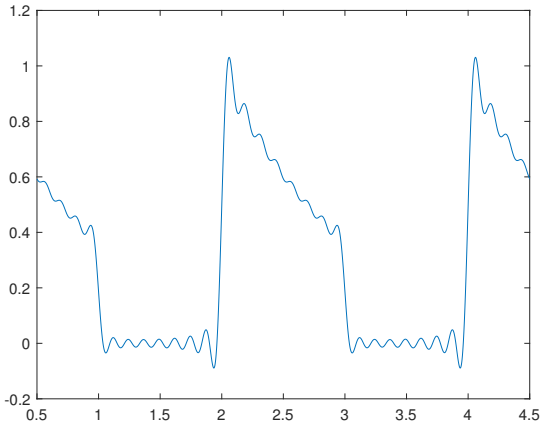

Figure 6. 8(a)-3.

The graph of $S_N(t)$ with $N = 19$ for $t \in [0.5, 4.5]$ is

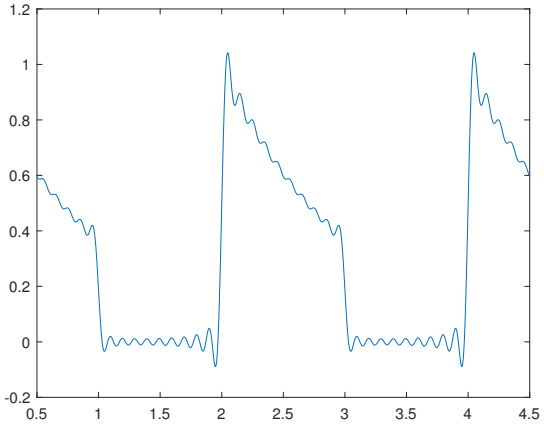

Figure 7. 8(a)-4.

From the graphs I see that the general shape and discontinuities of $S_N(t)$ does not change obviously as N increases, but the sawteeth of the curve increases as N increases proportionally. In general, the shape of the graph becomes closer to $x(t)$ as N increases.

(b) Use Matlab to calculate $S_N(0)$ and $S_N(1)$ for the N values in (a).

When $N = 5$, $S_N(0) = 0.4822$, $S_N(1) = 0.1891$.

When $N = 10$, $S_N(0) = 0.4902$, $S_N(1) = 0.1879$.

When $N = 15$, $S_N(0) = 0.4935$, $S_N(1) = 0.1861$.

When $N = 19$, $S_N(0) = 0.4949$, $S_N(1) = 0.1857$.

Hence, we can make an educated guess that $S_N(0) \to \frac{1}{2}$ and $S_N(1) \to \frac{1}{2e}$ when $N \to \infty$.

10.

(d) The graph of the magnitude of the system's frequency response $|H(j\omega)|$ as a function of ω is

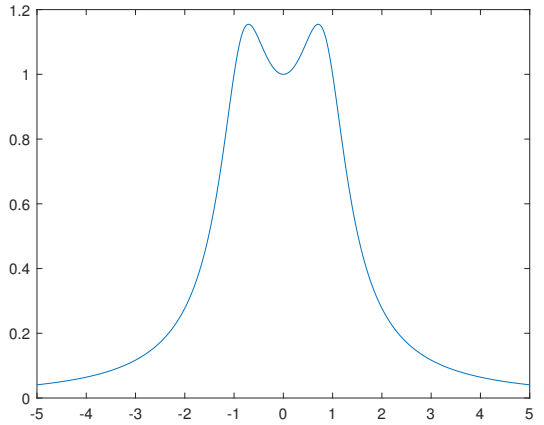

Figure 8. 10(d).

(e) The MATLAB code is shown below:

```
1  a=[1];
2  b=[1 1 1];
3  w=linspace(-5,5,10000);
4  h=freqs(a,b,w);
5  plot(w,abs(h));
```

The graph is

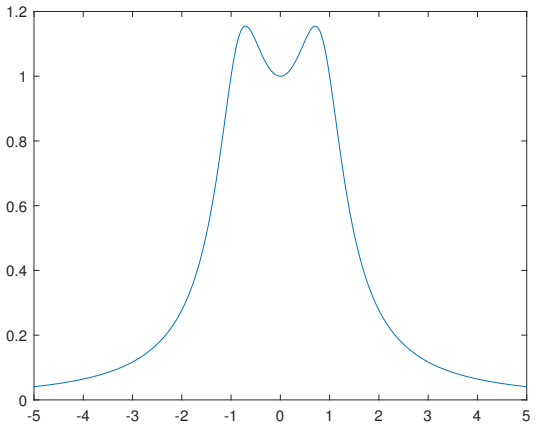

Figure 9. 10(e).

(f) The power density spectrum of $x(t)$ is

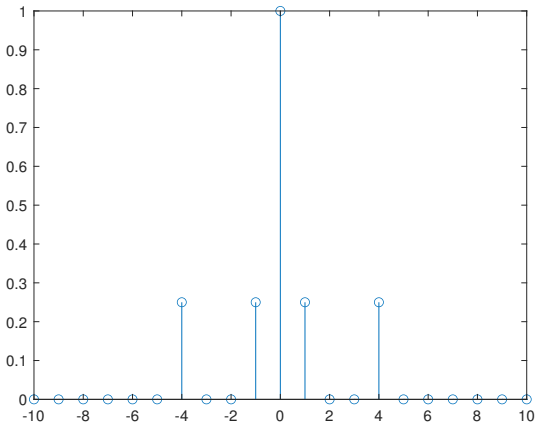

Figure 10. 10(f).

(h) The power density spectrum of $y(t)$ is

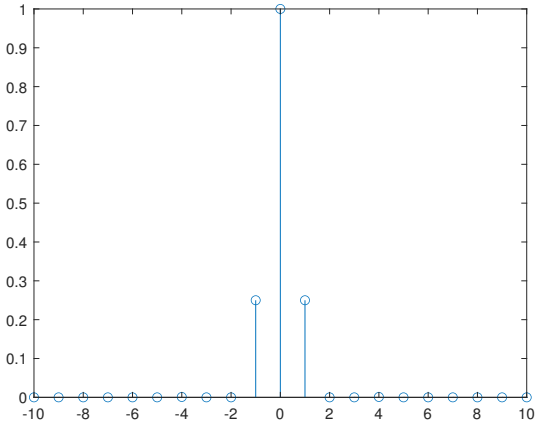

Figure 11. 10(h).

12.
(a) The graph of the fi
lter's magnitude response is

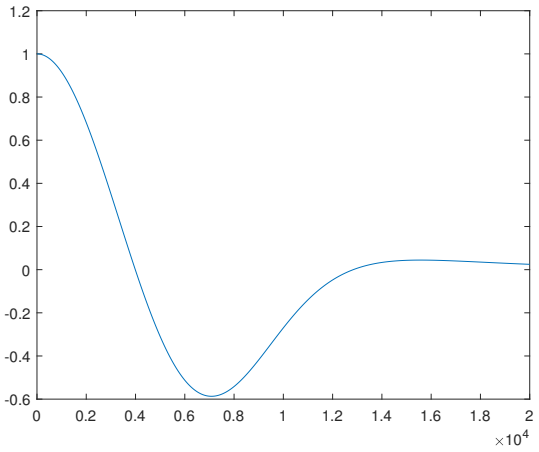

Figure 12. 12(a).

(b) The graph of the generated signal is

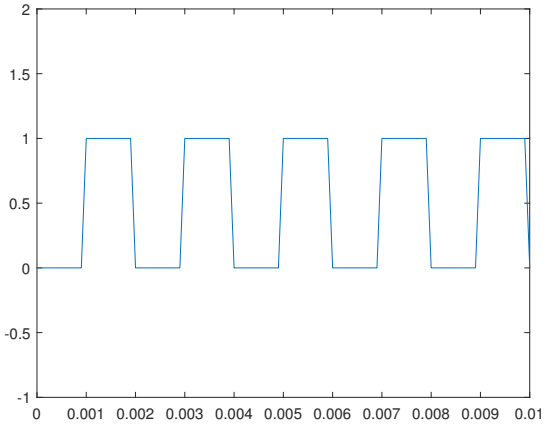

Figure 13. 12(b).

(c) The graph of the output signal is

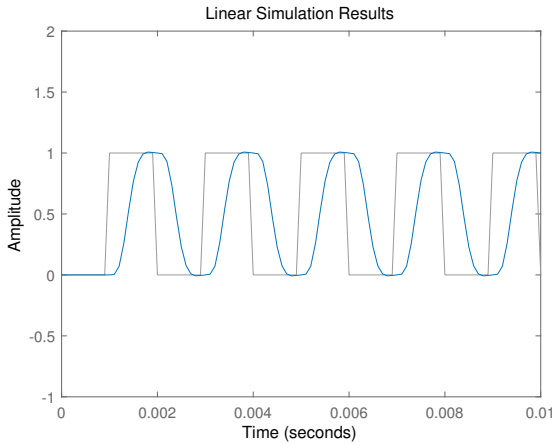

Figure 14. 12(c).