Lab Assignment

Imports, Functions and Variables

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Part A

* **Problem A.1**

Code:

Results:

* **Problem A.2**

Code:

Results:

* **Problem A.4**

Code:

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Results:

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* **Problem A.5 – A.6**

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Part B. Discussion

* **Problem B.1**

Both x1(t) and x2(t) share a fundamental frequency of π/10, reflecting their periodic nature. In contrast, x3(t) has a different periodic characteristic, with a fundamental frequency of π/20, defining their behavior in the frequency domain.

* **Problem B.2**

x1(t) exhibits a simpler harmonic structure with a limited set of Fourier coefficients, while x2(t) possesses a potentially infinite set, highlighting its more complex harmonic content in the frequency domain.

* **Problem B.3**

Despite a shared rectangular pulse shape, x2(t) and x3(t) have differing Fourier coefficients due to distinct periods. Varied periods directly influence their fundamental frequencies, leading to different distributions of non-zero Fourier coefficients.

* **Problem B.4**

In x4(t), similar to x2(t) but shifted downward by 0.5 units, the DC component is -0.5, altered by the downward shift from x2(t)'s zero DC component.

* **Problem B.5**

Augmenting the number of Fourier coefficients for x1(t) and x2(t) enhances the accuracy of signal reconstruction, minimizing approximation errors inherent in Fourier series estimations.

* **Problem B.6**

While ideal perfect reconstruction necessitates an infinite number of Fourier coefficients, signals like x1(t) with limited bandwidth require only a finite number. More complex waveforms such as x2(t) and x3(t) benefit from increased coefficients for accurate reconstruction.

* **Problem B.7**

Storing Fourier coefficients is an efficient means of signal representation, especially for large datasets or limited storage space. This method captures crucial frequency components, enabling accurate reconstruction when needed, commonly used in signal processing applications for data compression and storage. Feasibility depends on signal characteristics and application requirements.